RESULTS AND DISCUSSION

I. Laboratory Trials

Susceptibility of Field Samples and Their F_1 :

Results in Table (1) show the LD_{50}'s slopes and X^2 for both field samples and their first filial generation from three different governorates and the laboratory culture for three insecticides. It is noticeable that the differences in both LD_{50} values and slopes in the laboratory culture for both generations are minimal, indicating the stability of the susceptibility level of this culture, of particular significance in this respect is the slope, since it is a reflection of the homogenity of the test animals, being the reciprocal of the variance (Finney, 1971). This was not the case in Dakahlia and profenofos, however, the values of the slopes are more or less comparable in all the other cases.

The differences in LD_{50}'s also were small, and statistical analysis revealed the absence of any significant differences between field samples and their first filial generation propagated in the laboratory.

Ahmed et al. (1979) concluded that a mortality curve computed from experiments carried out on three successive days is comparable statistically to the usual one day test. Their objective was to find a method suitable to the conditions of field collected samples, where enough larvae may not be available for a screening test. The above results may represent another solution to the problem, by rearing field collected egg-masses for one generation in the laboratory in order to obtain an abundance of uniform larvae which may be used in a conventional test, since this rearing for one generation would cause no significant differences in the susceptibility of the sample.

Results of the X^2 tests in the above data may be taken to indicate the lines represent adequately the data obtained (Finney, 1971).

Day to Day Variations :

One of the problems often encountered in conducting routine screening tests is the day to day variations in the results obtained, a phenomenon which Finney (1971) describes as a data contaminate.

This is usually counteracted by a complete randomized block design of experiments.

It was thought, however, of interest to investigate the degree of variability which occurs under the standardized conditions prevalent while the present work was carried out, since the temperature and humidity were both controlled, full sanitation was used, size-space relationship was observed, and food standardised as much as a natural source of food allows.

Two experiments were run on two different days using the same generation of the laboratory culture. The insecticides used were profenofos, chlorpyrifos, monocrotofos, DDT and cypermethrin and results are given in Table (2). An inspection of the figures reveals that no two corresponding figures were the same, the value of LD_{50} differed in the first trial and second trial in all the insecticides used, the maximum difference was in monocrotofos where the difference was about 25 percent. When the "t" value was calculated for the two obtained values of this parameters on two different occasion, no significant difference was found.

In trials with DDT, again females were found more susceptible than males, the later having a LD_{50} value 1.9-fold higher than that of females and the difference was found significant. The LD_{50} value of males was 1.88 times higher than that of females in experiments with cypermethrin, although the difference was not statistically significant, however, the difference cannot be ignored. It is evident from the above results that males were less susceptible to insecticides than females. Judging by the value of LD_{50}, mostly this difference in susceptibility was statistically significant.

The exception in the five insecticides investigated was chlorpyrifos, where the LD_{50} for females was slightly higher than that of males. The above results are graphically presented in Figs. (1-5).

The ascending order of potency of the insecticides used to both sexes was the same, being DDT, monocrotofos, profenofos, chlorpyrifos and cypermethrin, respectively.

There were always differences in slope between males and females, these differences were sometimes very small (cypermethrin) or substantial (profenofos).

Susceptibility of Female Adults and 4th Instar Larvae:

Values of LD_{50} slope X^2 and Student's "t" for LD_{50} for adult females and 4th instar larvae are given in Table (4). Comparison of the LD_{50} values reveals that in profenofos, chlorpyrifos, monocrotofos and DDT, 4th instar larvae were more susceptible than adult females. When the significance of the difference was statistically examined, it was found significant, for the above mentioned four insecticides. Paradoxically the LD_{50} for 4th instar larvae treated with cypermethrin was 2.3 times higher than that of female adults, the difference was found significant statistically.

The largest difference in susceptibility was found in experiments with DDT where the LD_{50} for female adults was 5.5 times higher than that of the larvae. Next in magnitude was the difference observed with profenofos, where the LD_{50} for adult females was 2.7 times higher than that of larvae.

In chlorpyrifos and monocrotofos the LD_{50}'s for female adults were 1.9 and 1.8 times higher than that of larvae, respectively.

In experiments with organophosphorus compounds and DDT the slopes of the Ld-p lines obtained, were consistantly higher for the adult females than the larvae (Figs.1,2,3 and 4) while these for cypermethrin they were slightly higher for larvae than female adults (Fig. 5)

Susceptibility of Male Adults and 4th Instar Larvae

Table (5) compares results of experiments carried out with five insecticides on male adults and 4th instar larvae . From these results it is obvious that 4th instar larvae are far more suceptible to profenofos, chlorpyrifos, monocrotofos and DDT than the adult males. The ratio between the two LD_{50}'s was 5.8 for profenofos, 1.6 for chlorpyrifos, 5.02 for monocrotofos and 10.5 for DDT. In all four cases the difference was found statistically significant. In cypermethrin, however, there was a slight difference in the value of LD_{50}'s. It was higher for the larvae than the adults. The difference was statistically not significant.

There were always small differences in slopes between male adults and 4th instar larvae. The

Table (2) : Comparison of data obtained on two different days with larvae from the laboratory culture treated with different insecticides.

Insecticides	First trial			Second trial			
	LD_{50} µg./Larva	Slope	X^2	LD_{50} µg./larva	Slope	X^2	T
Profenofos	0.262	1.94	0.48	0.239	1.82	0.55	0.531
Chlorpyrifos	0.183	1.88	2.14	0.170	1.81	0.46	0.379
Monocrotofos	8.625	0.96	2.60	6.617	0.85	2.67	0.77
DDT	4.080	1.50	0.73	4.536	1.46	0.73	0.63
Cypermethrin	0.159	1.36	1.94	0.158	1.47	1.63	0.30

Table (3) : Comparison of the susceptibility of female and male adults of Spodoptera littoralis to five insecticides.

Insecticides	Females			Males			
	LD_{50} µg./ Female	Slope	X^2	LD_{50} µg./ Male	Slope	X^2	T
Profenofos	0.656	2.17	3.79	1.384	1.64	3.69	4.62*
Chlorpyrifos	0.318	2.02	1.90	0.266	2.12	4.18	0.9
Monocrotofos	11.98	1.23	6.46	33.23	1.10	4.95	3.46*
DDT	25.03	1.32	3.99	47.70	1.40	1.54	2.7*
Cypermethrin	0.066	1.02	2.97	0.124	0.94	4.26	1.85

* Student "t" significant at p = 0.05

Table (4) : Comparison of the susceptibility of female adults and 4th instar larvae of Spodoptera littoralis to five insecticides.

Insecticides	Female adults			4th instar larvae			
	LD_{50} µg./ F.	Slope	X^2	LD_{50} µg./L.	Slope	X^2	T
Profenofos	0.656	2.17	3.74	0.239	1.82	0.55	7.3*
Chlorpyrifos	0.318	2.02	1.90	0.170	1.81	0.46	3.408*
Monocrotofos	11.98	1.23	6.46	6.617	0.85	2.67	1.984*
DDT	25.03	1.32	3.99	4.536	1.46	0.73	7.7*
Cypermethrin	0.066	1.02	2.97	0.152	1.41	1.38	3.26

* Student "t" significant at p = 0.05

Table (5) : Comparison of the susceptibility of male adults and 4th instar larvae of Spodoptera littoralis to five insecticides.

Insecticides	Male adults			4th instar larvae			
	LD_{50} µg./m.	Slope	X^2	LD_{50} µg./ L.	Slope	X^2	T
Profenofos	1.384	1.64	3.69	0.239	1.82	0.55	9.54*
Chlorpyrifos	0.266	2.14	4.18	0.170	1.81	0.46	2.16*
Monocrotofos	33.23	1.10	4.95	6.617	0.83	2.67	4.40*
DDT	47.70	1.40	1.52	4.536	1.46	0.73	10.37*
Cypermethrin	0.124	0.98	4.26	0.153	1.43	1.63	0.63

* Student "t" significant at p = 0.05

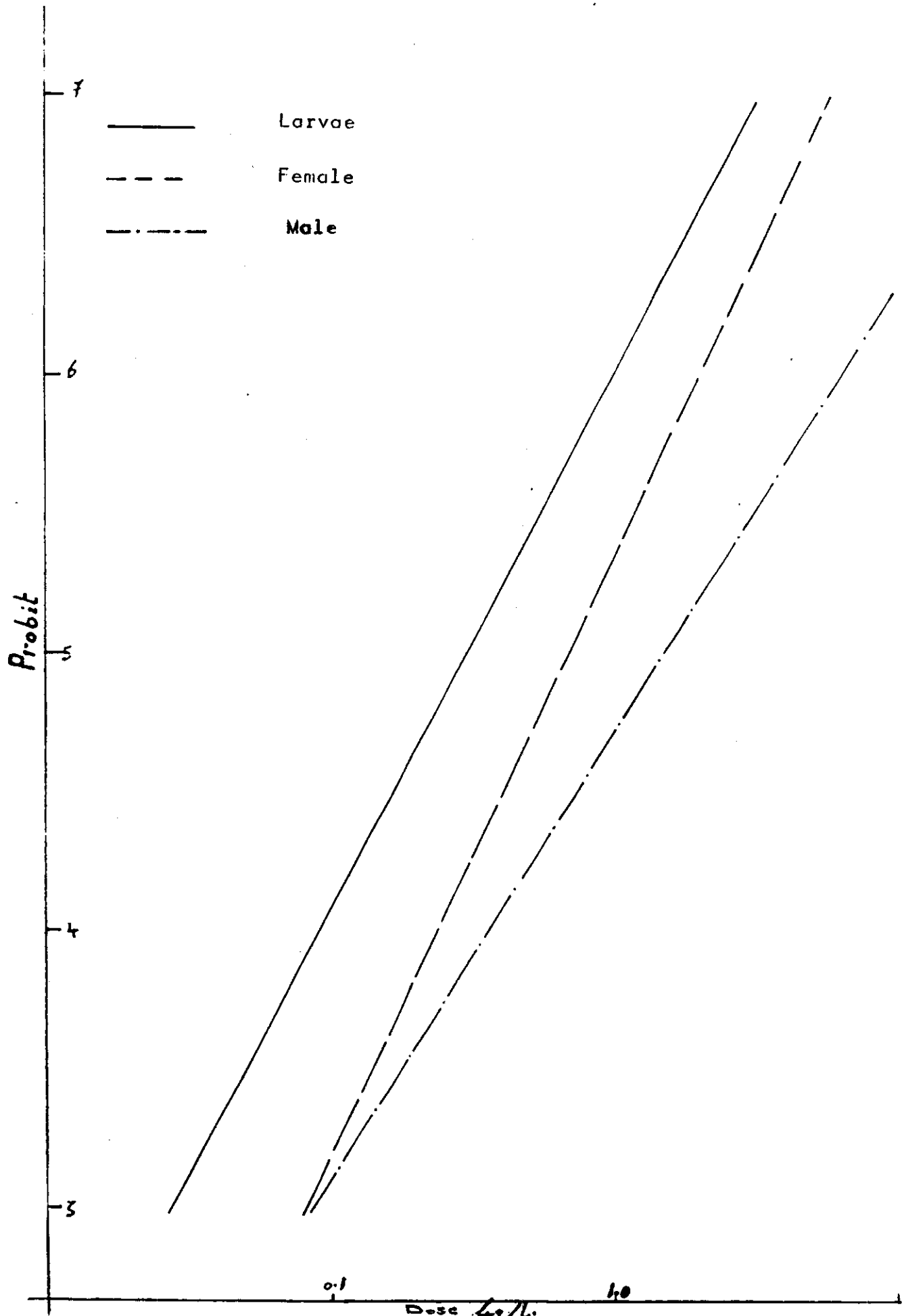

Fig. 1. LD-P Lines for male and female adults and Larvae of *S. littoralis* treated with Profenofos

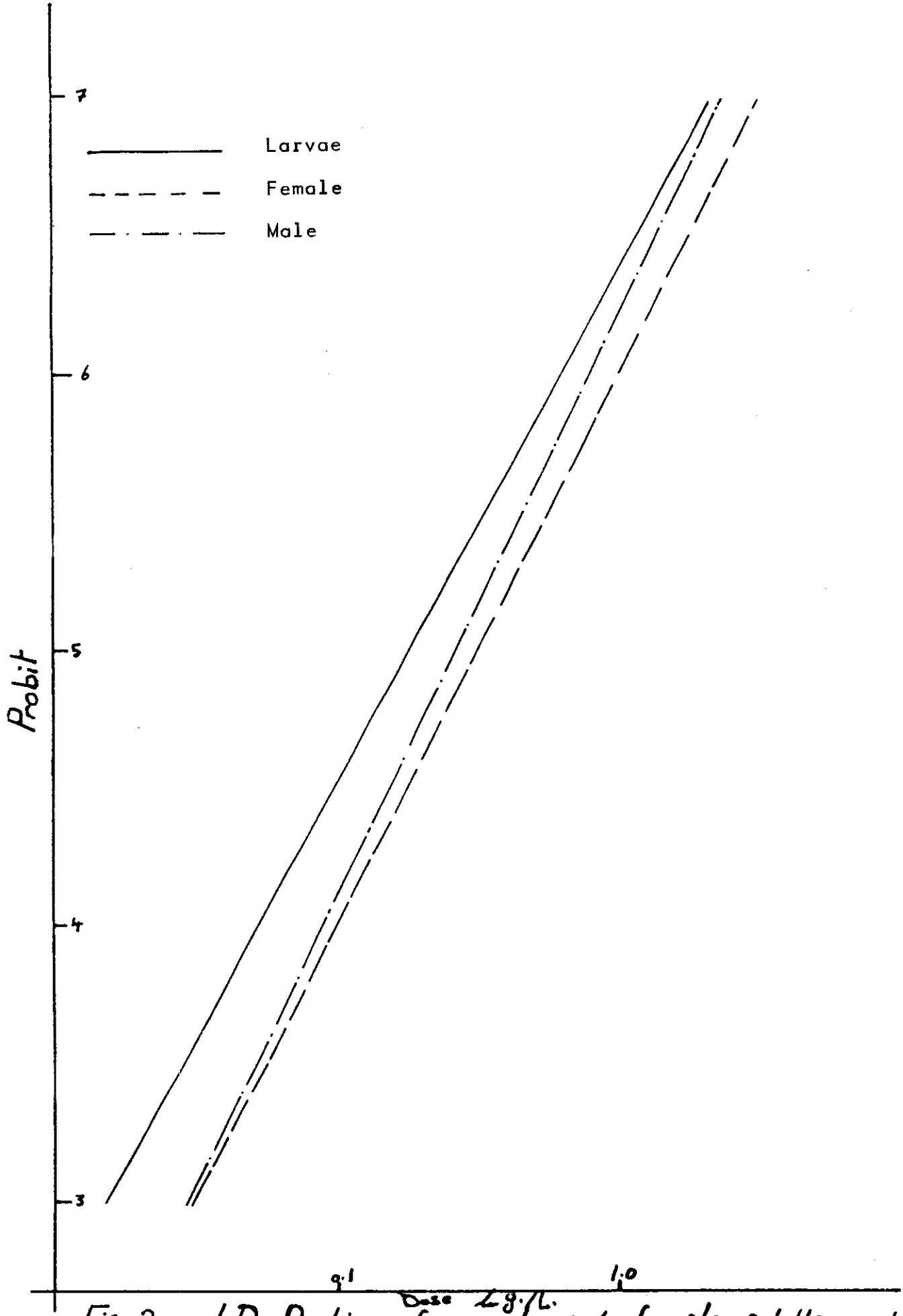

Fig. 2: LD-P lines for male and female adults and Larvae of S. Littoralis treated with Chlorpyrifos.

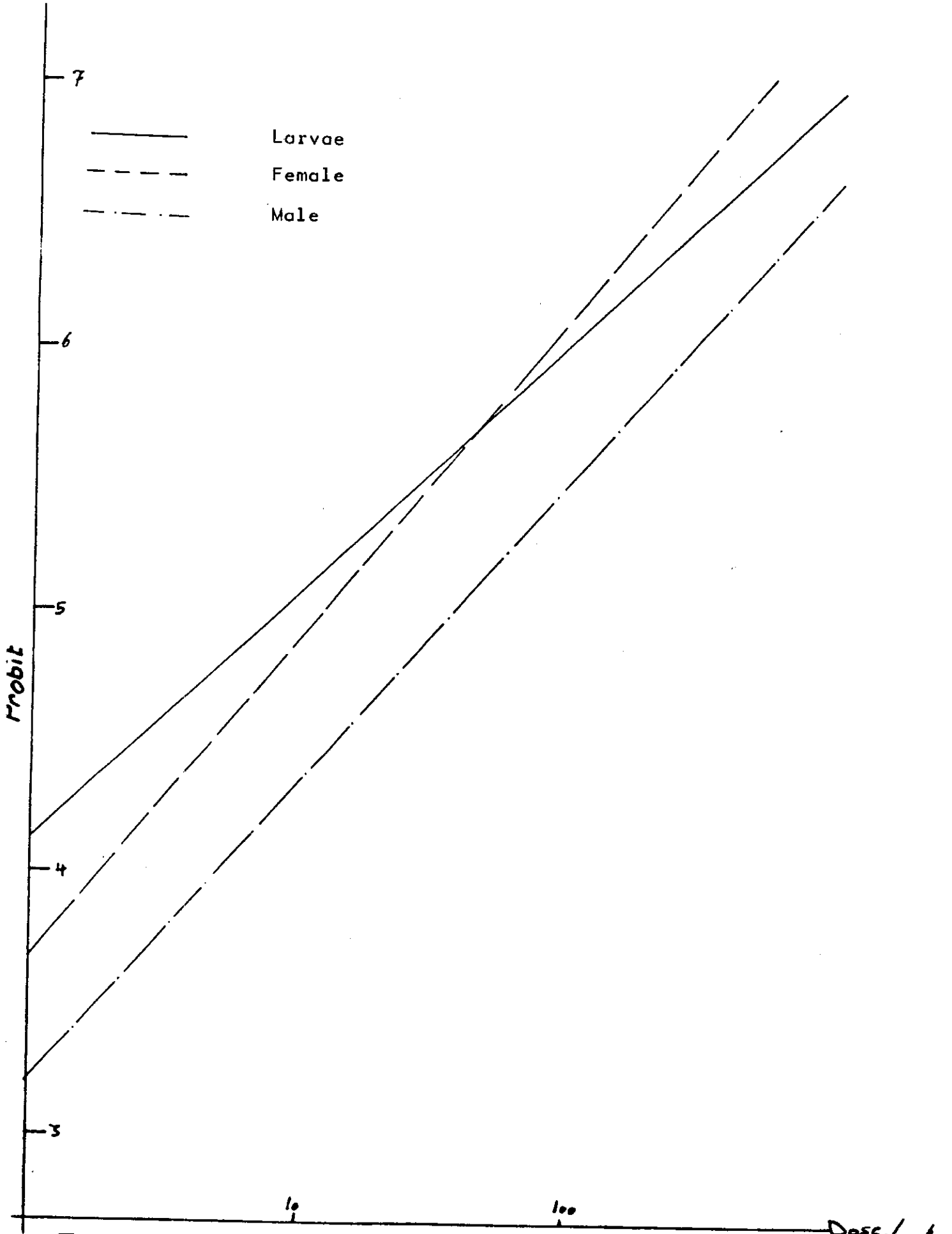

Fig. 3: LD-P Lines for male and female adults and Larvae of S. Littoralis treated with Monocrotofos

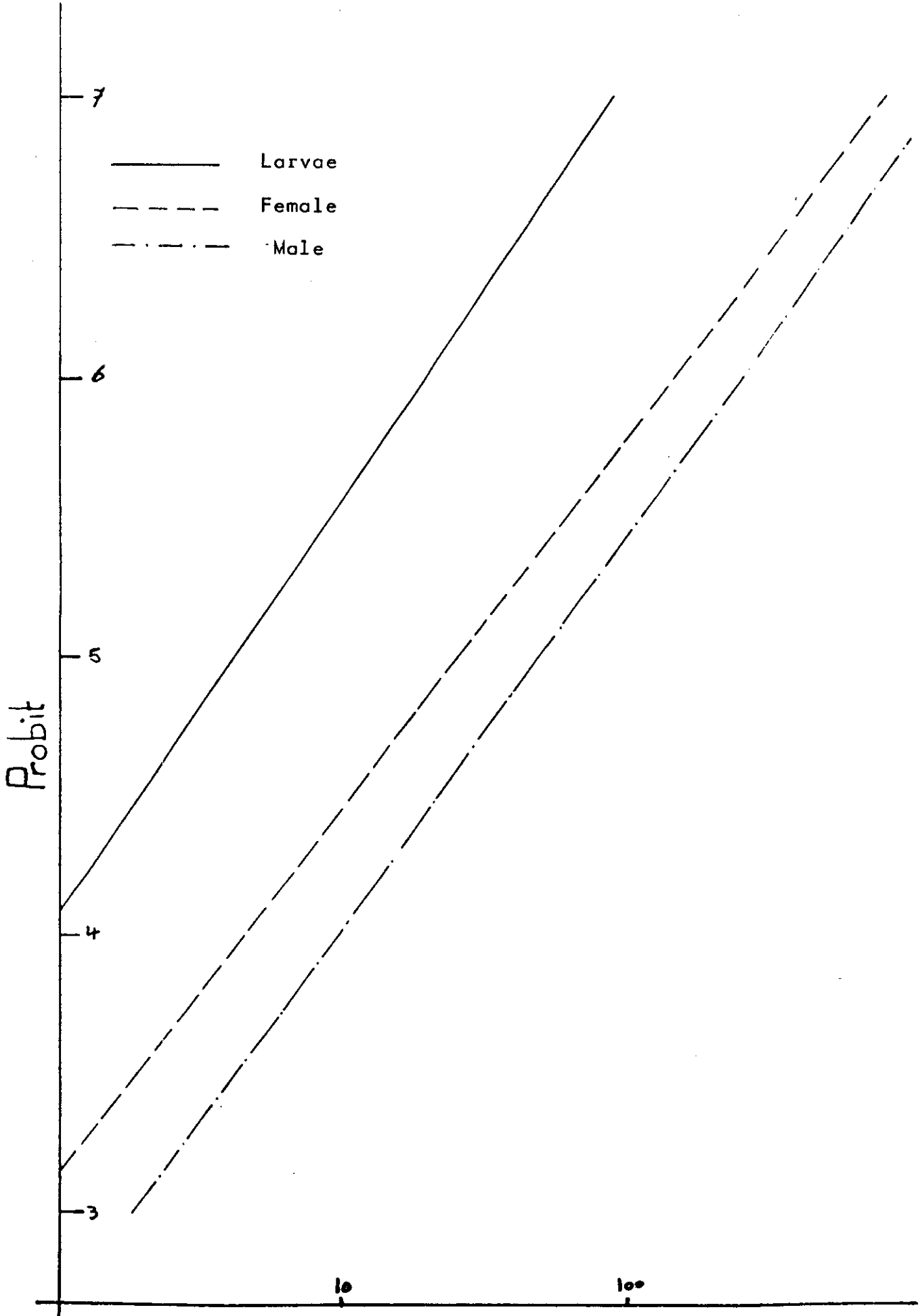

Fig:4 ; LD_P Lines for male and female adults and Larvae of S. Littoralis treated with DDT

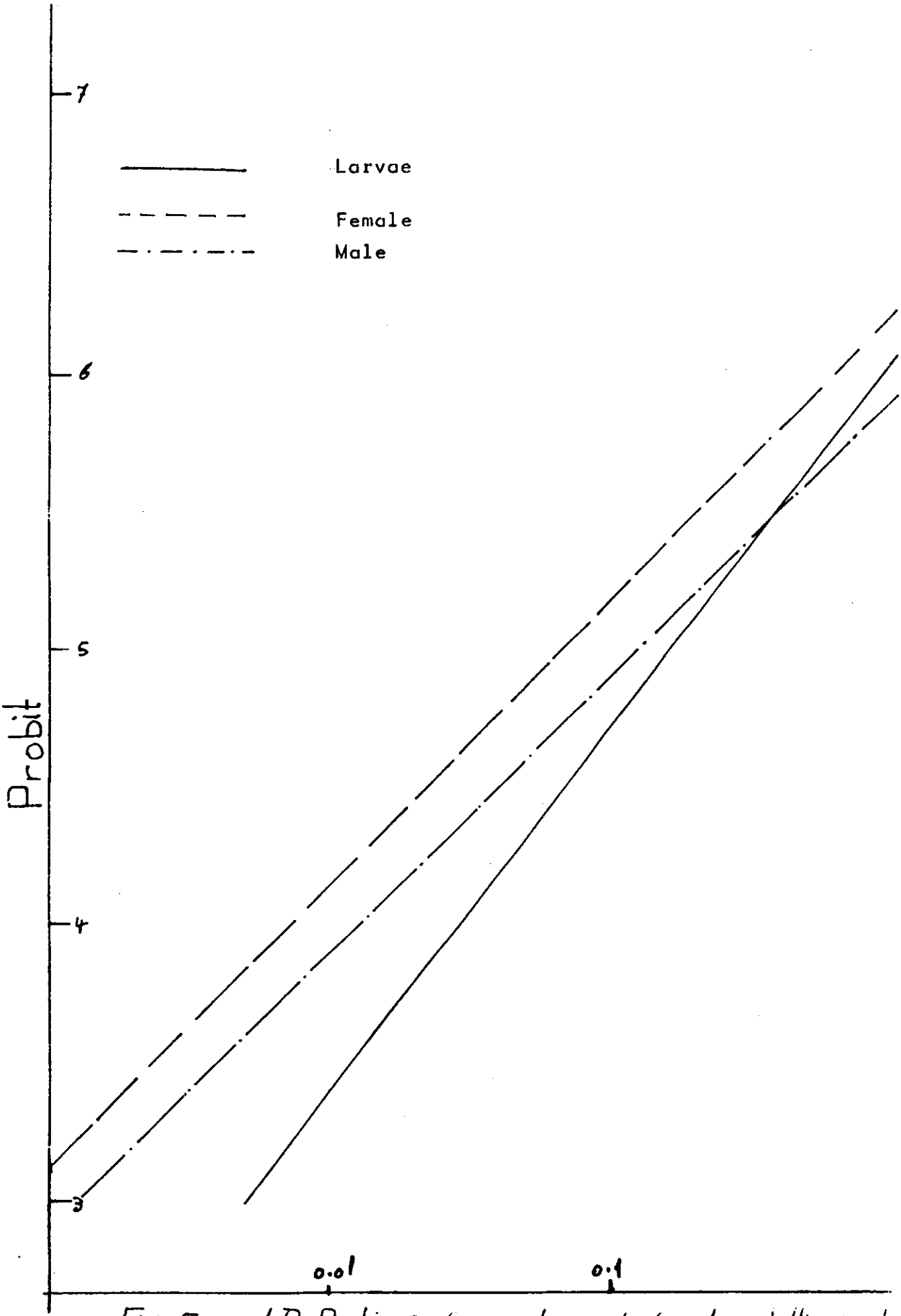

Fig 5: LD-P lines for male and female adult's and Larvae of S. Littoralis treated with Cypermethrin

II. Comparative Susceptibility of Field Samples

1. 1980 Season :

Susceptibility of Field Samples of *Spodoptera littoralis* to Profenofos Compared to a Laboratory Culture in Early and Late Season of 1980 :

Results in Table (6) and Figs. (6 and 7) show the results of probit analysis for both first filial generations from early season samples and late season samples collected from three different governorates and the laboratory culture treated with profenofos.

It is noticeable that the differences in the LD_{50}'s values in early season test were minimal. Statistically, there was no significant differences between laboratory culture and the field samples. The differences in the LD_{84} values in early season test were also negligible. Owing to a slightly flat curve, the highest value for LD_{84} was that of Dakahlia samples. A considerable degree of parallellism was noticed in Ld-P lines of the three governorates and the laboratory culture.

The least slope of these lines was that obtained from Dakahlia samples (Table, 6), followed by that of Gharbia, while Sharkia samples gave more or less a value for the slope similar to that of the laboratory culture. All the values of X^2 were not significant statistically.

In the late season test, the differences in the values for LD_{50}'s and LD_{84}'s were negligible with the exception of samples from Dakahlia, where the two values were apparently higher than the usual standard. Statistical analysis, however, revealed that these values were not significantly different from those of the other governorates or the laboratory culture.

The slopes were more or less similar in all the samples investigated and slightly lower than that of the laboratory culture. The differences in LD_{50}'s in early and late season for laboratory culture and the three governorates also were small, and statistical analysis revealed the absence of any significant differences between early season test and late season test.

The above results are in line with the findings of Dittrich et al. (1979) who stated that from five governorates samples of S. littoralis were uniformly susceptible to profenofos.

Table (6) : Susceptibility of field Spodoptera littoralis to Profenofos compared to a laboratory culture in early and late seasons of 1980.

Strain	Early season				Late season				T for early and late season
	LD_{50} µg/L.	LD_{84} µg/L.	Slope	X^2	LD_{50} µg/L.	LD_{84} µg/L.	Slope	X^2	
Lab.	0.275	0.892	1.96	0.25	0.258	0.891	1.86	0.18	0.37
Sharkia	0.221	0.724	1.94	2.55	0.290	1.067	1.77	2.61	1.539
Gharbia	0.200	0.780	1.69	0.99	0.294	1.322	1.53	0.73	1.923
Dakahlia	0.266	1.234	1.50	0.77	0.305	1.897	1.80	1.63	0.706

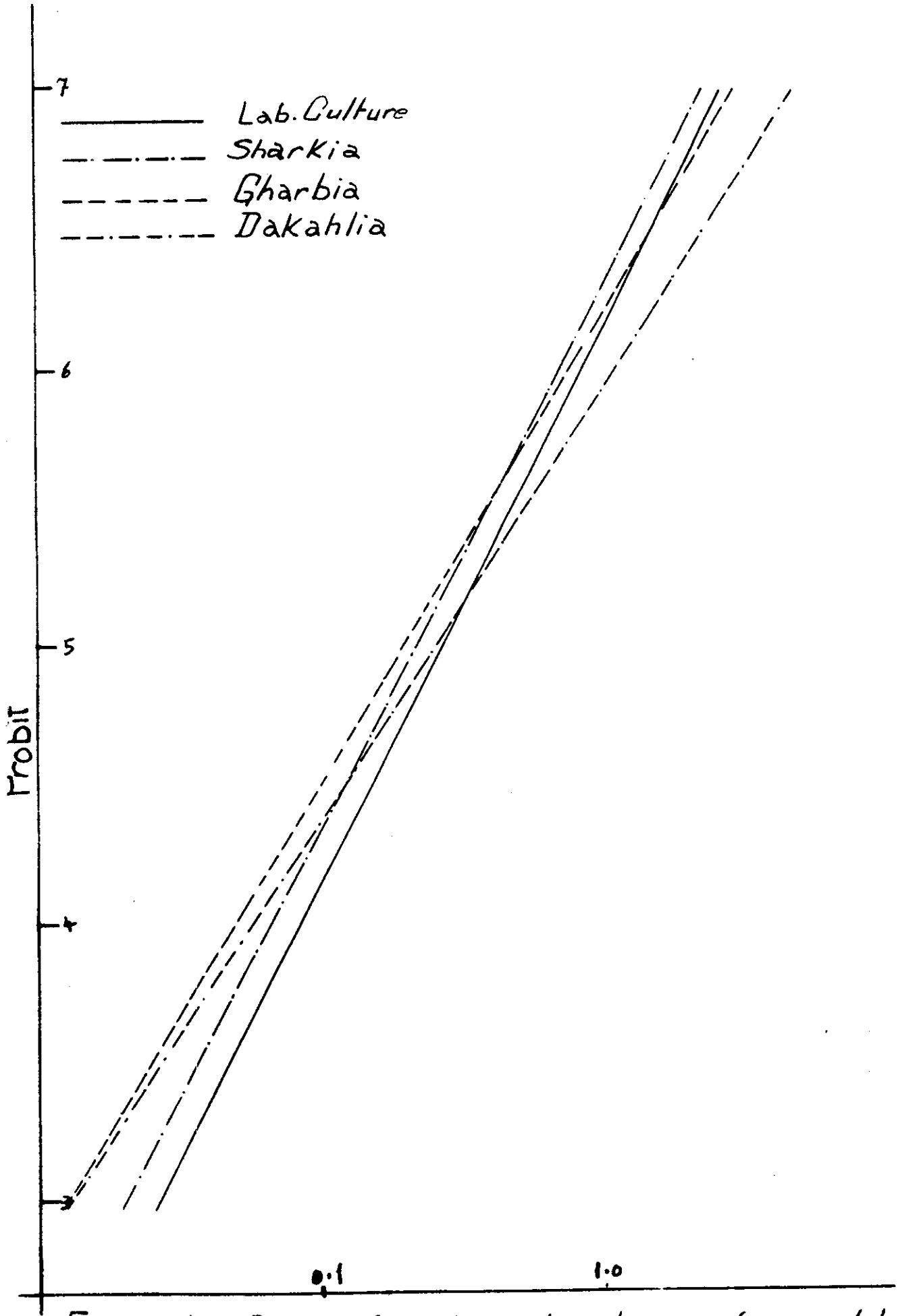

Fig 6; LD-P Lines for 4th. instar Larvae from a laboratory culture and samples from different Governorates treated with profenofos in early season of 1980

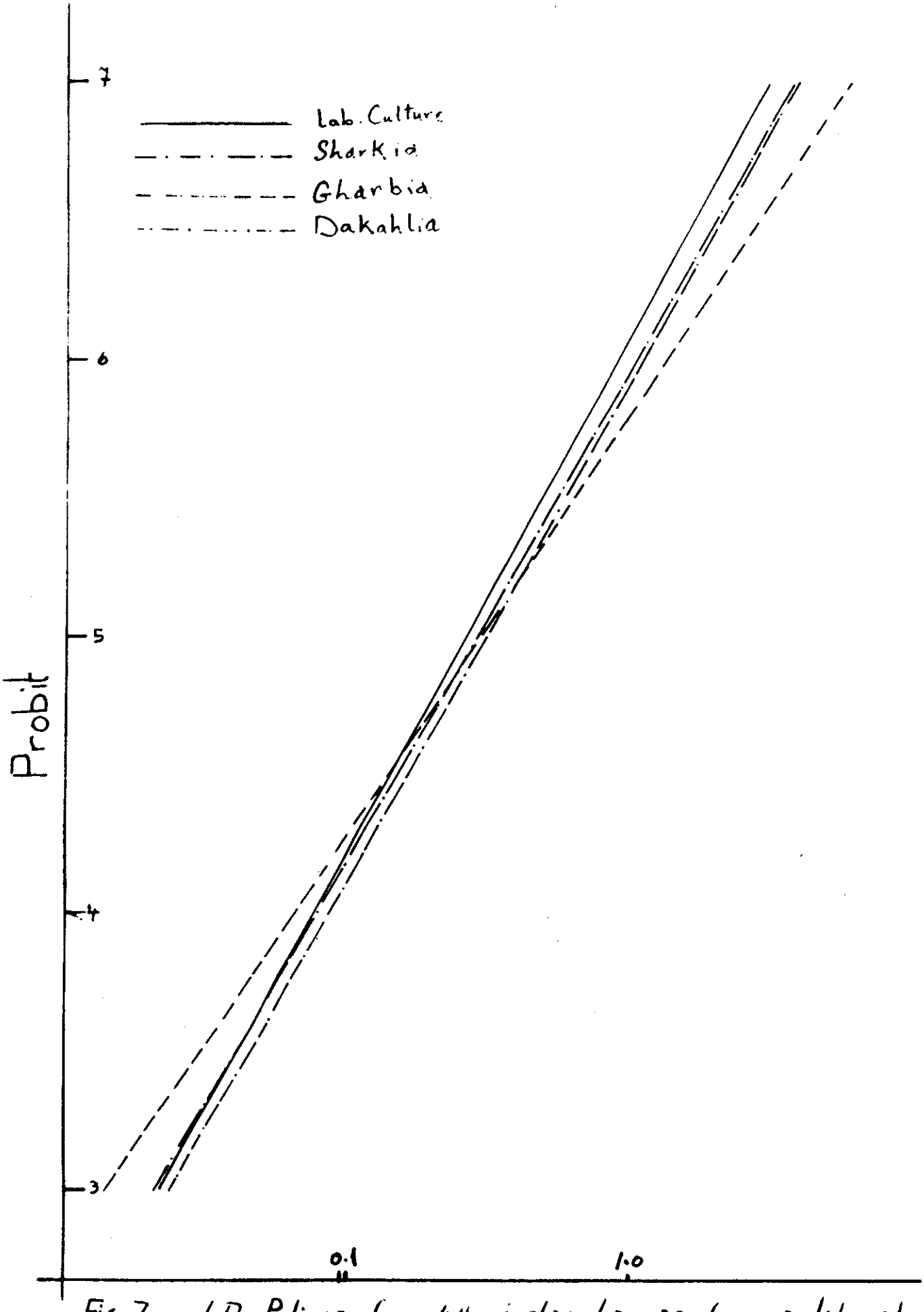

Fig 7: LD-P lines for 4th. instar Larvae from a laboratory culture and samples from different governorates treated with Profenofos in late season of 1980

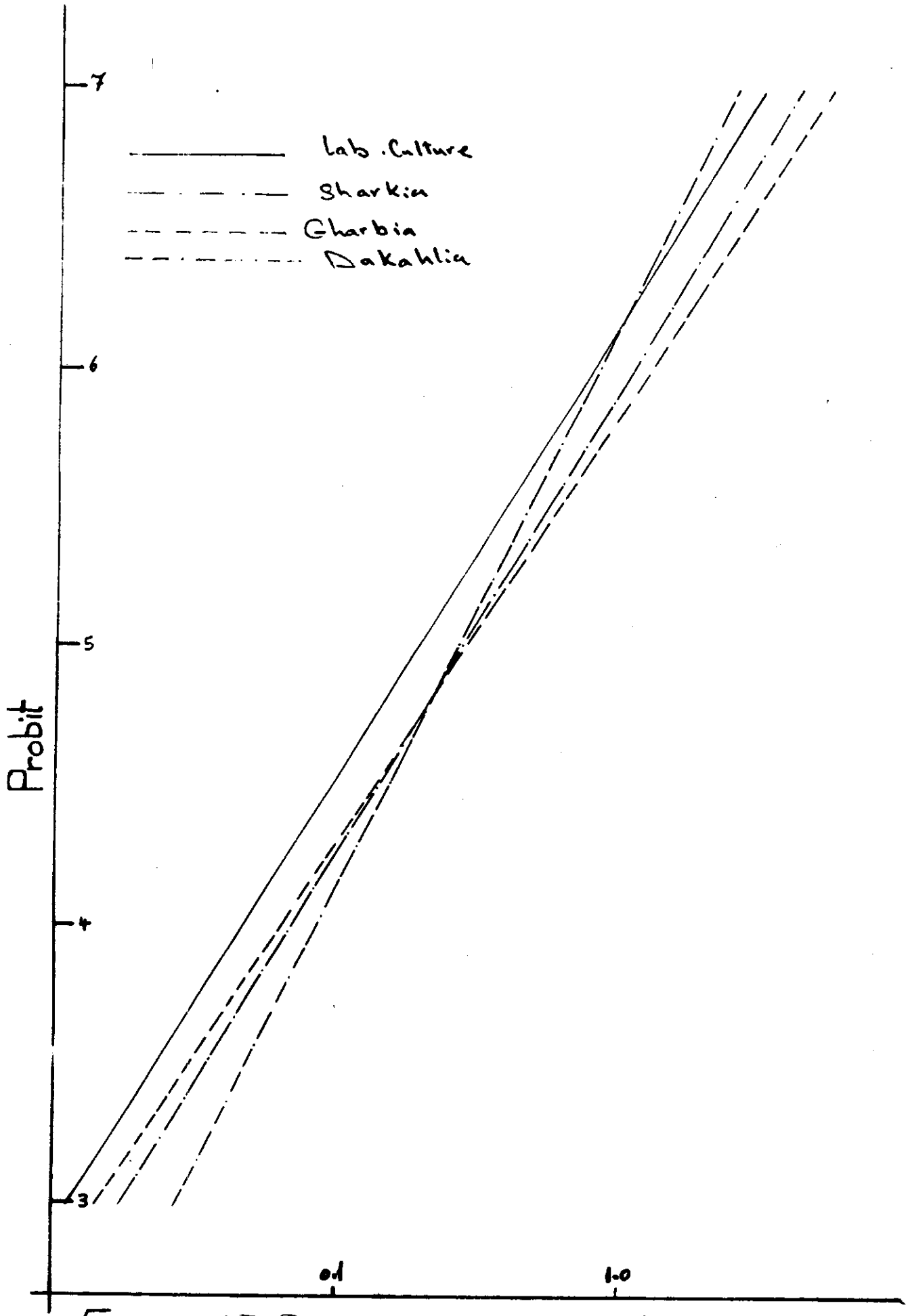

Fig 8: LD-P Lines for 4th. instar Larvae from a laboratory Culture and Samples from different governorates treated with Chlorpyrifos in early season of 1980

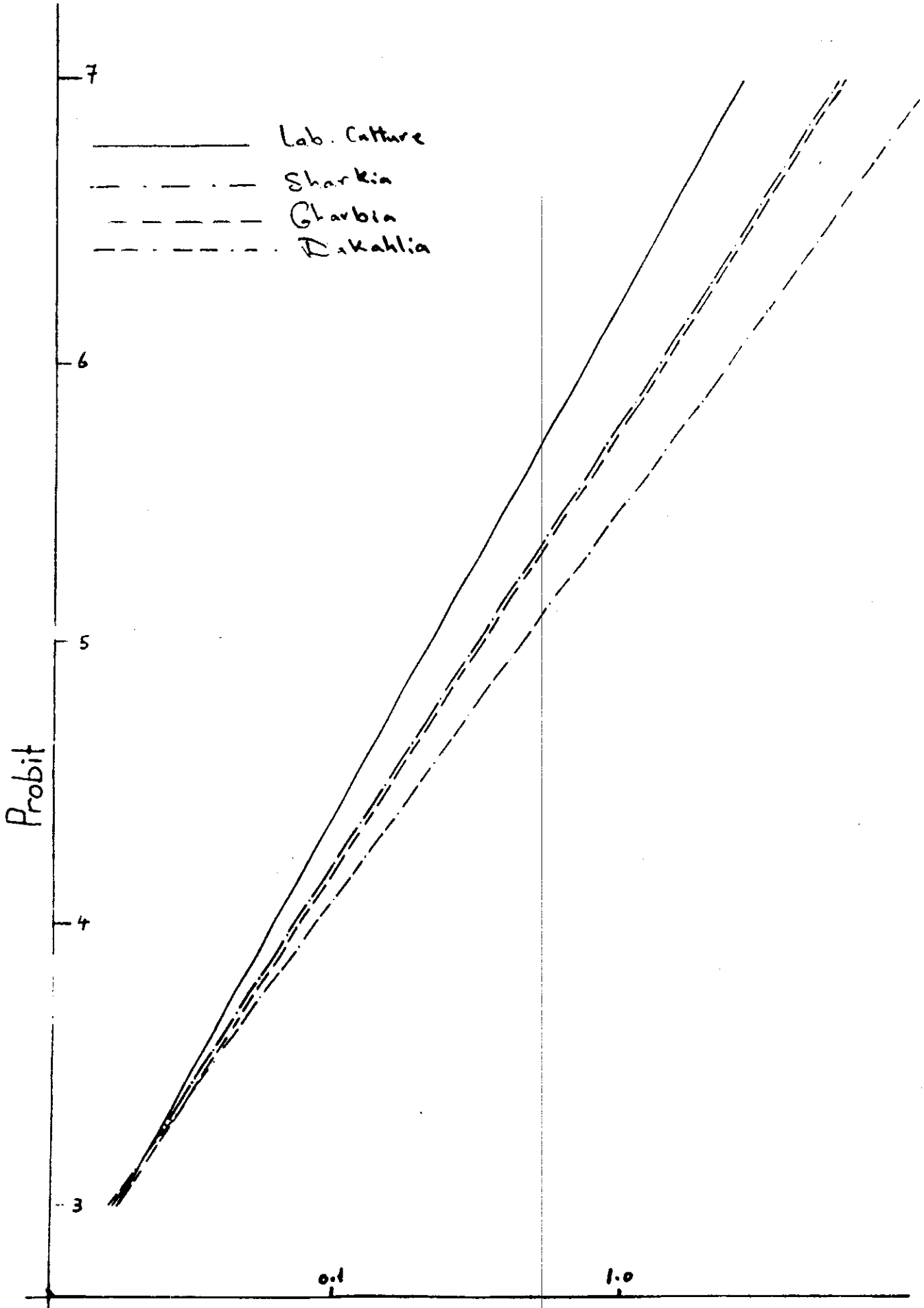

Fig 4: LD-P Lines for 4th. instar larvae from a laboratory culture and samples from different governorates treated with chlorpyrifos; late season 1980

Susceptibility of Field Samples of Spodoptera littoralis to Monocrotofos Compared to a Laboratory Culture in Early and Late Season of 1980 :

From Table (8) and Figs. (10 and 11) it is apparent that monocrotofos is generally less toxic to larvae of Spodoptera littoralis in comparison with profenofos and chlorpyrifos.

Differences between the values of LD_{50}'s from different samples were generally small. The lowest value for LD_{50} of samples was from Dakahlia. It was lower than that of the laboratory culture. The highest value came from samples from Sharkia. The differences, however, were not statistically significant. The differences in slopes brought about differences in the arrangement of susceptibility according to higher fractional mortality, i.e. LD_{84} Dakahlia samples showed an exceptionaly low slope, and this caused a substantial rise in the value of LD_{84} to be the highest among the samples tested, while Sharkia gave the highest slope and the smallest LD_{84} accordingly. In samples from Gharbia, although LD_{50} value was only slightly higher than that of the laboratory culture, but owing to a difference of 0.1

in the slope in favor of the laboratory culture, the value of LD_{84} for Gharbia sample became 1.22 times higher than that of the laboratory culture. In the late season all the values of LD_{50}'s increased slightly in comparison with the early season. The biggest increase was noticed in samples collected from Sharkia where the LD_{50} for the late season was increased by ca. 2 mg./g. than that of the early season. The arrangement of the susceptibility of the samples, however, remained the same as in early season, i.e. Dakahlia, laboratory, Gharbia and Sharkia in a descending order, respectively. Differences between samples and laboratory culture were not statistically significant and differences between the values of LD_{50}'s in early and late season were also not significant. Differences in slope between samples taken in the late and early season were negligible. Also the differences in the value of LD_{84} was slight with the exception of, samples from Sharkia, where there was a considerable difference owing to slight lowering in the slope in late season samples. In all cases X^2 was not significant indicating homogenity of data.

Tolerance to monocrotofos was reported by Abdel-Aal (1977) and Dittrich (1979). The above mentioned results, however, did not indicate tolerance, it rather indicated that the insecticides were not initially effective against this pest.

Table (8) : Susceptibility of field Spodoptera littoralis to monocrotofos compared to a laboratory culture in early and late seasons of 1980.

Strain	Early season				Late season				T for early and late season
	LD_{50} µg/L	LD_{84} µg/L.	Slope	X^2	LD_{50} µg/L.	LD_{84} µg/L.	Slope	X^2	
Lab.	5.007	35.536	1.17	2.09	5.201	36.927	1.17	1.30	0.145
Sharkia	5.857	34.631	1.30	2.41	7.235	44.889	1.26	2.79	0.85
Gharbia	5.042	43.255	1.07	2.20	5.801	42.319	1.16	1.57	0.515
Dakahlia	3.612	48.45	0.95	3.28	4.293	47.160	0.96	4.82	0.503

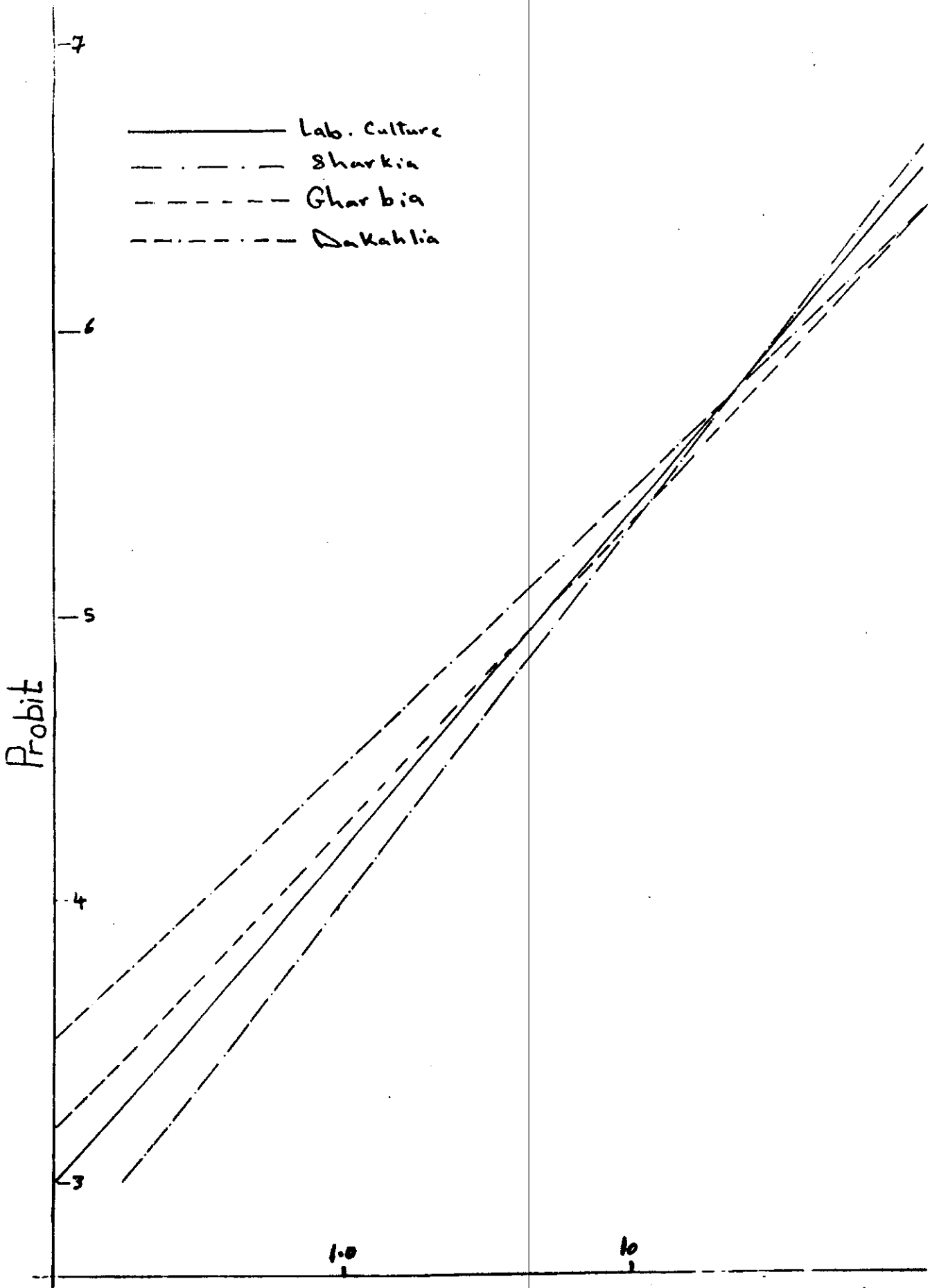

Fig 10 : LD_P Lines for 4th. instar Larvae from a laboratory Culture and samples from different governorates treated with Monocrotofos in early season 1980

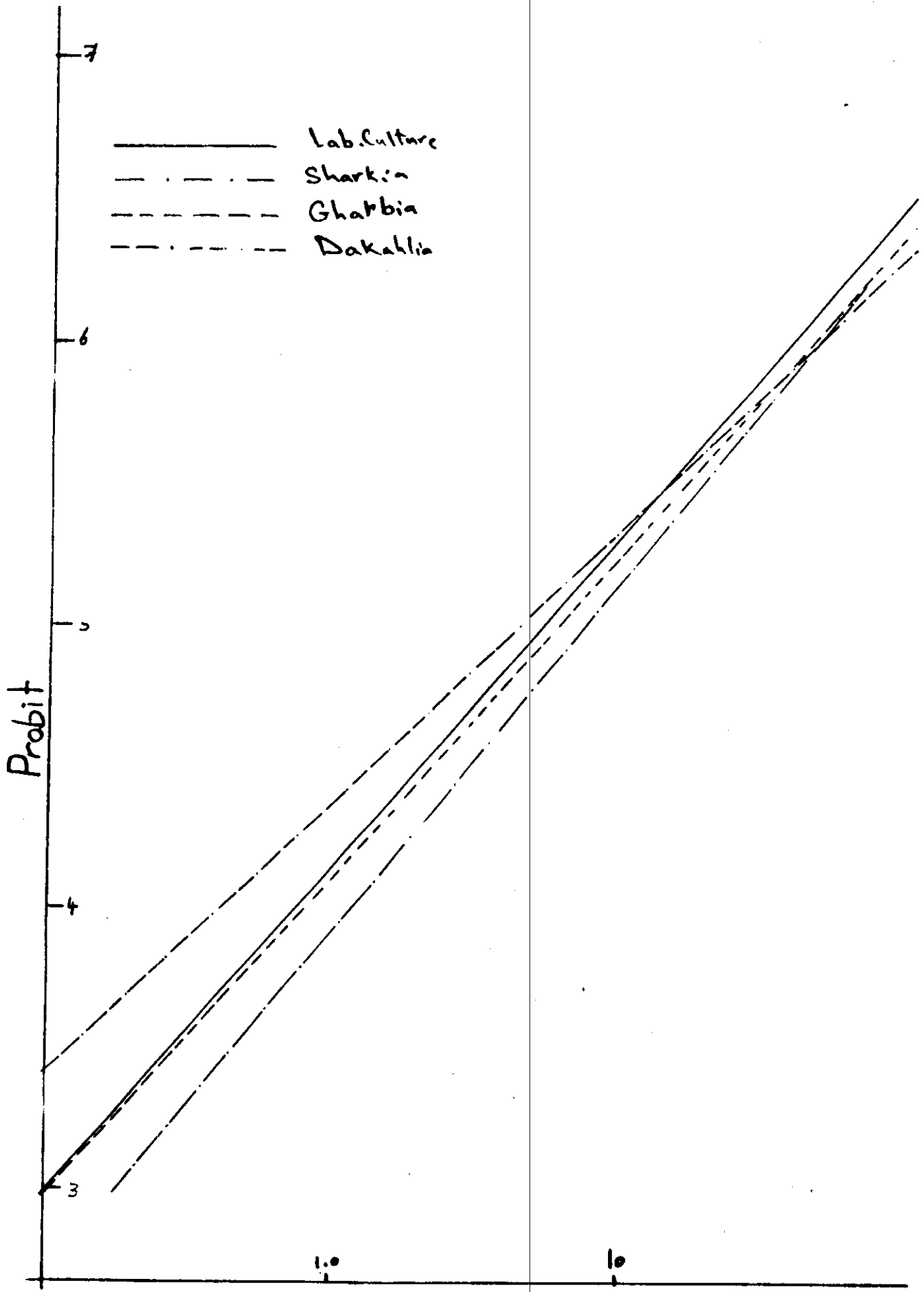

Fig 11: LD-P Lines for 4th. instar Larvae from a laboratory culture and samples from different governorates treated with Monocrotofos in late season 1980

2. 1982 Season :

Susceptibility of Field Samples to Profenofos Compared to a Laboratory Culture in Early and Late Season of 1982 :

Results in Table (9) show the LD_{50}'s, LD_{84}'s, slopes and X^2 for both early and late F_1 generation from three governorates and tha laboratory culture for profenofos. It is evident that in the early season test, the differences in LD_{50}, LD_{84} and slope were small. The exception was the Dakahlia sample where the values of LD_{50} and LD_{84} were significantly higher than the laboratory culture. The LD_{50} value for Dakahlia was 1.78 times higher than that of the laboratory culture. It is noticeable, however, that samples from Gharbia, had an LD_{50} value, slightly, but insignificantly smaller than that of the laboratory culture. It is evident that Dakahlia sample had a low slope to it's Ld-P line (Figs. 12 and 13). On the other hand, the slope of the laboratory culture, and it's LD_{50} were equal to those of the sample from Sharkia. The sample from Gharbia had a slightly lower slope. In the late season test, the LD_{50} and LD_{84} values for both Gharbia and Dakahlia

were higher than those reported for the early season test (Table, 9). The differences in LD_{50}'s,however, were not statistically significant when compared to the laboratory culture with the exception of the sample from Dakahlia, which, as in early season test differed significantly from the value for the laboratory culture. It was 2.01-folds higher than the figures for the laboratory culture.

When the figures for the LD_{50}'s were compared in the same governorates for early and late season, the differences were small and statistically not significant, with the exception of the sample from Gharbia which had an LD_{50} value 1.84 folds higher in the late than in the early season and the difference was statistically significant.

There were minimal differences in slopes between the two seasons, and still the Dakahlia sample had the lowest slope (Fig. 13) while the laboratory culture had the highest slope. A slight increase was also noticed in the slope of the Gharbia and Dakahlia samples in comparison with the early season, while the slope for Sharkia was slightly lower in the late season than the early season (Figs. 12 and 13).

In all the tests carried out, the value of X^2 was not significant.

Table (9) : Susceptibility of field Spodoptera littoralis to profenofos compared to a laboratory culture in early and late seasons of 1982.

Strain	Early season				Late season				T for early and late season
	LD_{50} µg/L.	LD_{84} µg/L.	Slope	X^2	LD_{50} µg/L.	LD_{84} µg/L.	Slope	X^2	
Lab.	0.254	0.827	1.95	0.21	0.276	0.858	2.03	0.68	0.499
Sharkia	0.249	0.835	1.90	0.07	0.271	0.964	1.82	1.64	0.500
Gharbia	0.193	0.881	1.51	2.10	0.357	1.511	1.60	1.72	2.82*
Dakahlia	0.451*	3.743*	1.09	1.10	0.554*	4.022	1.16	2.03	0.70

* Student "t" significant p = 0.05

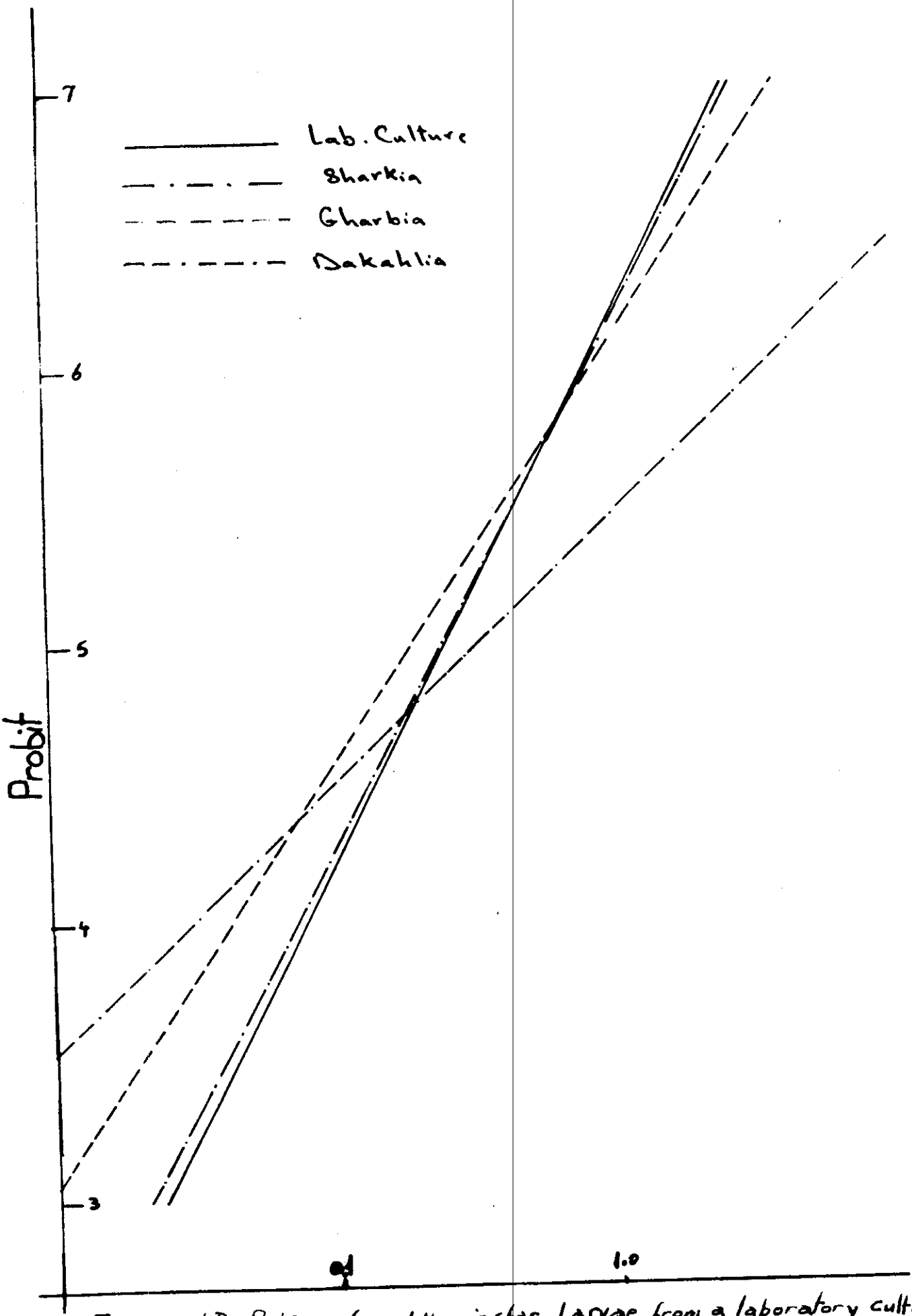

Fig 12: LD-P Lines for 4th. instar Larvae from a laboratory culture and samples from different governorates treated with Profenofos in early season 1982

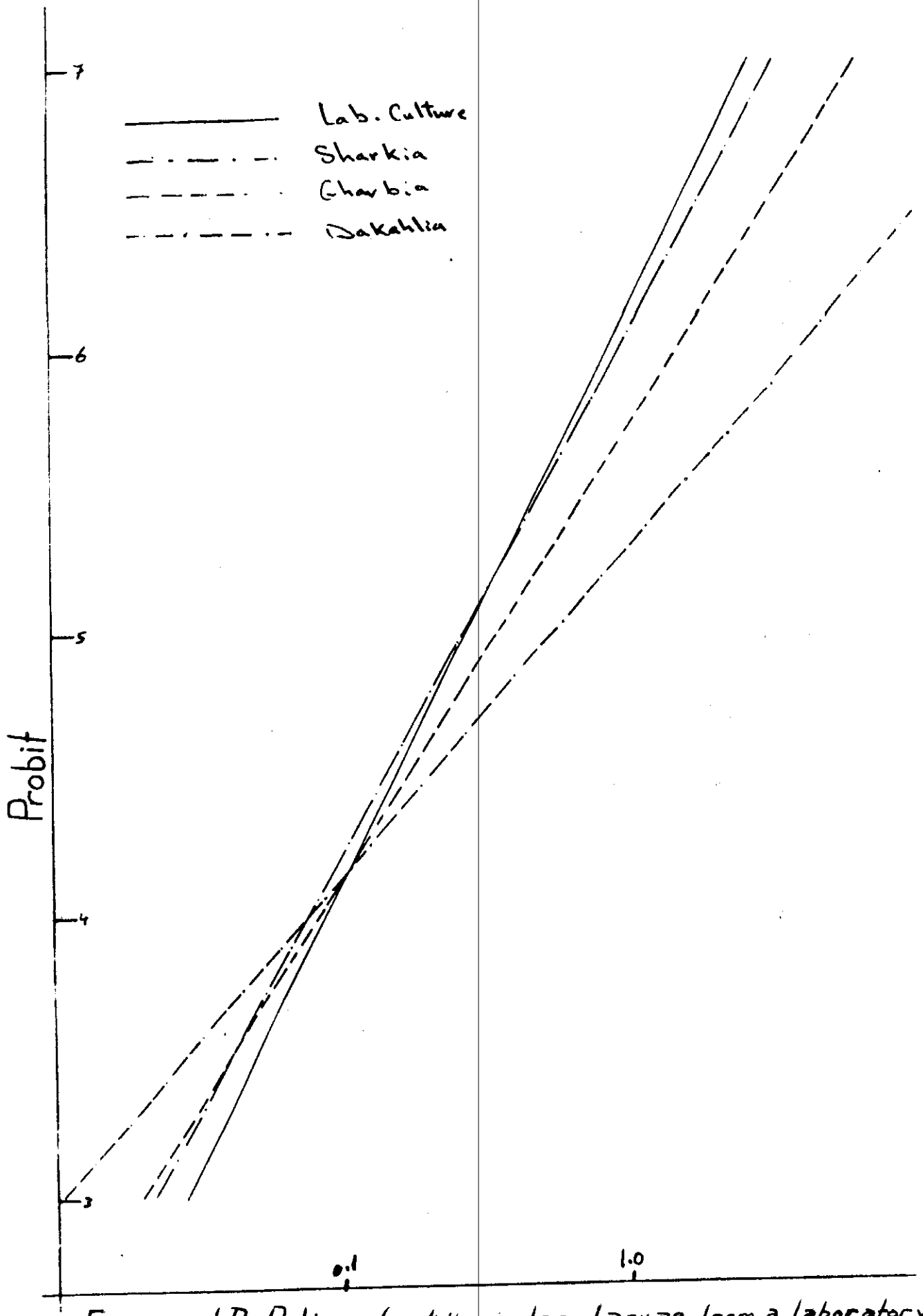

Fig 13: LD_P lines for 4th. instar Larvae from a laboratory culture and samples from different governorates treated with Profenofos in late season 1982

The highest figure for both LD_{50} and LD_{84} obtained, however, was that of Dakahlia. The values of Gharbia and Sharkia were more or less similar X^2 values in all cases were not significant.

There were increases in the values of LD_{50}'s and LD_{84}'s in the late season as compared to the early season, these increases were not statistically significant. The differences between samples from Dakahlia and other governorates are smaller in the late season than in the early season and all samples had a statistically significant higher LD_{50} and LD_{84} than the laboratory culture. The slopes in both seasons (Figs. 14 and 15) were always lower in samples from the different governorates than that of the laboratory cultures. Differences in slopes from early to late season were always small.

Values of X^2 were always not significant statistically.

Table (10) : Susceptibility of field Spodoptera littoralis to chlorpyrifos compared to a laboratory culture in early and late seasons of 1982.

Strain	Early season				Late season				T for early and late season
	LD_{50} µg/l.	LD_{84} µg/l.	Slope	X^2	LD_{50} µg/l.	LD_{84} µg/l.	Slope	X^2	
Lab.	0.159	0.630	1.67	2.00	0.166	0.642	1.70	1.37	0.19
Sharkia	0.288	1.677	1.31	2.27	0.433*	3.221	1.15	0.17	1.583
Gharbia	0.298*	1.517	1.42	0.53	0.407*	2.641	1.23	1.06	1.345
Dakahlia	0.402*	2.802	1.18	2.14	0.483*	2.989	1.26	2.57	0.70

* Student "t" significant at p = 0.05

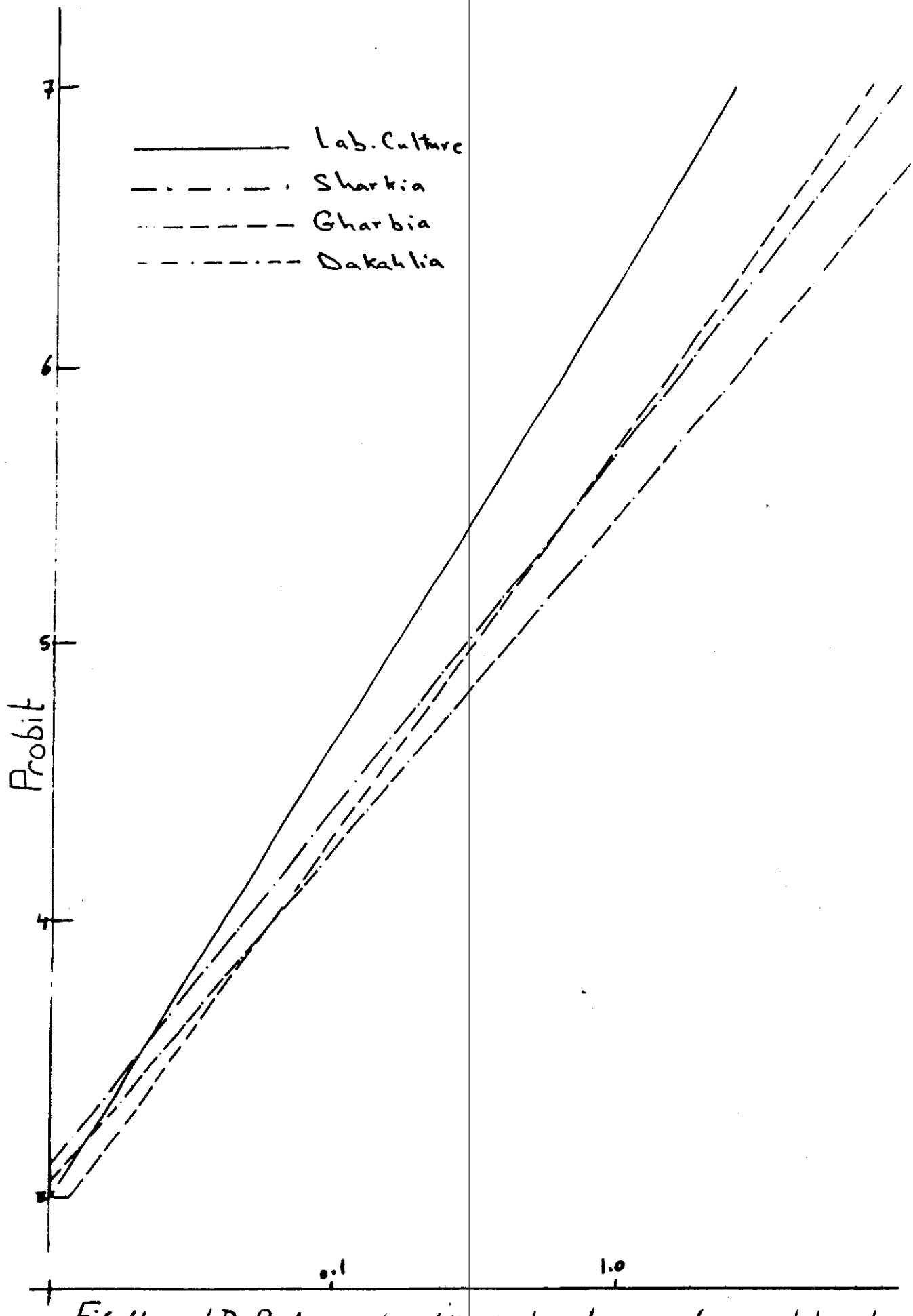

Fig 14: LD-P lines for 4th instar Larvae from a laboratory culture and samples from different governorates treated with Chlorpyrifos, early season 1982

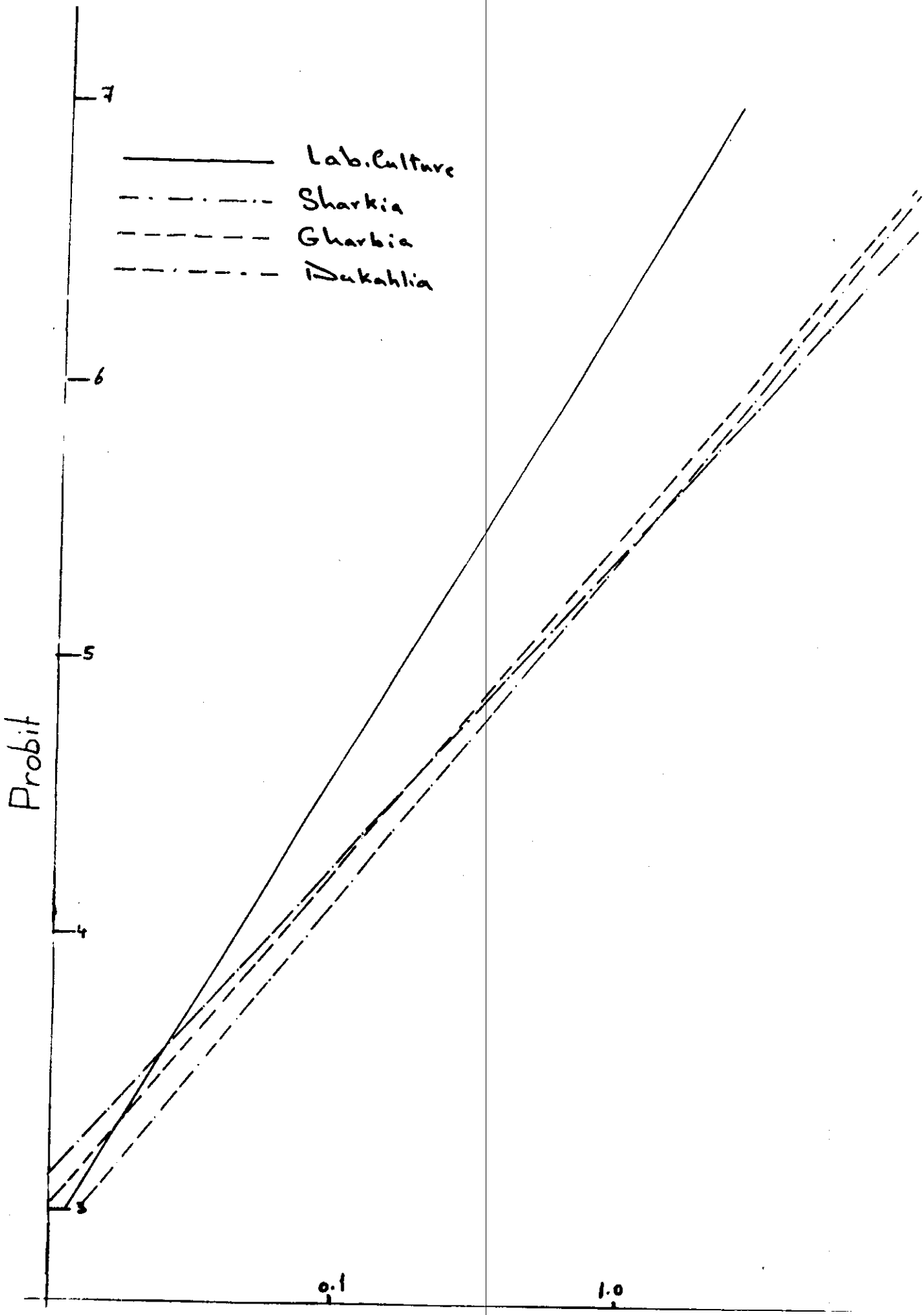

Fig 15: LD-P lines for 4th. instar Larvae from a laboratory culture and samples from different governorates treated with Clorpyrifos in late season 1982

Susceptibility of Field Samples to Monocrotofos compared to a Laboratory Culture in Early and Late Season of 1982 :

The results in Table (11) show the values of LD_{50}, LD_{84} slope and X^2 for both early and late season for laboratory culture and samples from governorates treated with monocrotofos. The differences in the LD_{50} values in the early season test were negligible where, the Sharkia sample had the highest value and the Dakahlia sample showed the lowest values, the ratio between the two figures was only 1.48. The differences in the LD_{84} values in early season test were small between the field samples. As a whole, the LD_{84} for the field samples were higher than that of the laboratory culture, but without statistical significance.

It was observed that all the slopes of this toxicant were low and the differences between different samples were rather small. It was noticed, however, that the slopes for the laboratory culture and the sample from Sharkia were more or less equal, while those of samples from Gharbia and Dakahlia were more or less equal. In the late season test, with the exception of Dakahlia samples, there was a small

increase in the LD_{50} values, this increase was more marked in samples from both Sharkia and Gharbia, while it was very slight in the laboratory culture.

In Dakahlia there was a slight drop in the value of LD_{50} in the late season as compared to the early season test. All these differences, however, were not significant. The differences between LD_{84} values were small with the Gharbia sample showing the highest value and Dakahlia giving the lowest value.

The slopes in the late season test were also small with small differences between samples. It may be concluded, however, that the change in late season tests with this insecticide were minimal, and the Ld-P lines were more parallel with no crossing over points in the late season (Fig. 17).

Table (11): Susceptibility of field Spodoptera littoralis to monocrotofos compared to a laboratory culture in early and late seasons of 1982.

Strain	Early season				Late season				T for early and late season
	LD_{50} µg/l.	LD_{84} µg/l.	Slope	X^2	LD_{50} µg/l.	LD_{84} µg/l.	Slope	X^2	
Lab.	6.737	82.245	0.92	1.88	6.858	100.455	0.86	2.18	0.05
Sharkia	8.955	104.174	0.94	2.08	10.08	118.33	0.93	1.89	0.35
Gharbia	8.528	157.724	0.79	0.87	10.35	118.82	0.94	0.68	0.52
Dakahlia	6.032	147.394	0.77	3.59	5.942	82.576	0.87	0.35	0.03

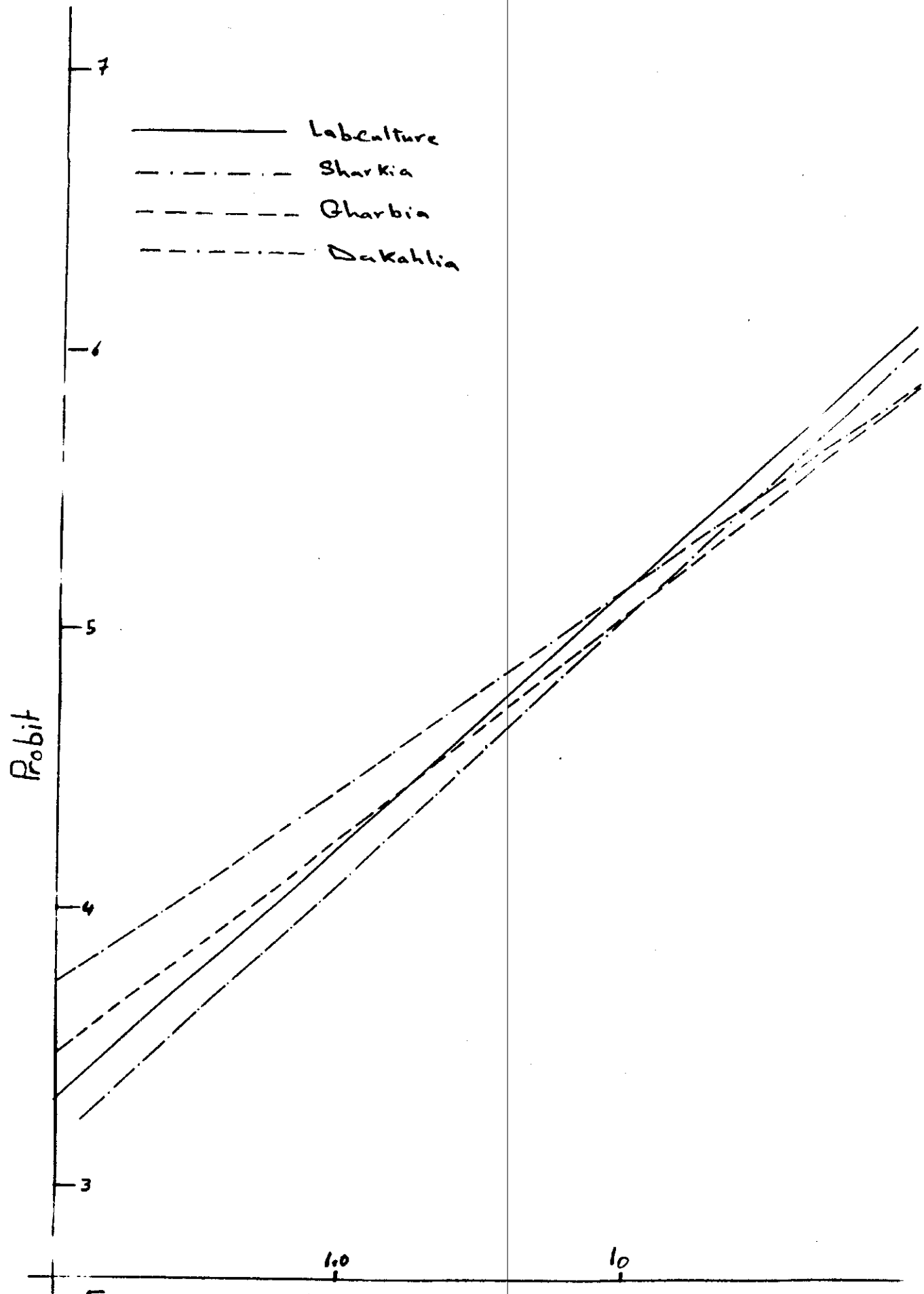

Fig 16: LD-P lines for 4th. instar Larvae from a laboratory Culture and Samples from different governorates treated with Monocrotofos in early season 1982

Susceptibility of Field Strains to DDT Compared to a Laboratory Culture in Early and Late Seasons of 1982:

The results in Table (12) show the values of LD_{50}, LD_{84}, slope and X^2 for both early and late season test for three governorates to a laboratory culture tested with DDT. The differences between LD_{50}'s and LD_{84}'s in the early season test between the laboratory culture and samples from governorates was evident, the sample from Gharbia had the highest value and the laboratory culture showed the lowest. The LD_{50} value for Gharbia was 3.73 folds higher than that of the laboratory culture. When "t" value was calculated, it revealed that these differences between Sharkia and Gharbia values and the laboratory culture were significant, while the value of LD_{50} for Dakahlia was not significantly different from that of the laboratory culture. The same trend described for LD_{50}'s was noticed with the LD_{84}'s, there were higher in field samples than the laboratory culture. Sharkia and Gharbia were higher than Dakahlia. The slopes of Ld-P lines were more or less similar with the exception of Sharkia sample where the slope was lower than the other samples (Fig. 18).

In the late season tests, the value of LD_{50} for the laboratory culture did not change, but there were increases in this parameter for the samples from the different governorates. The differences between the values of LD_{50} from the three governorates were statistically significant in comparison with the laboratory culture. The only sample that showed a statistically significant difference in the late season test as compared to the early season was that from Sharkia.

The values of LD_{84}'s in the late season were generally higher than those of the early season. This difference was most marked in the sample from Sharkia, the slopes for the Ld-P lines in the late season were slightly lower than those of the early season in the laboratory culture, Sharkia and Gharbia samples. This was most obvious in the Ld-P line for Sharkia (Fig. 19). In Dakahlia the value of slope for the early and late season Ld-P lines were more or less similar.

El-Guindy (1975) indicated the presence of resistance to DDT in S. littoralis in the Dakahlia governorate. His work covered the period 1970 up to

1973. The present figures indicate that a significant difference in susceptibility existed between the laboratory culture and the field samples, this differences was least apparent in Dakahlia samples. These differences and the more or less similar slopes suggest vigour tolerance rather than tolerance due to selection. This is most probable owing to the fact that DDT has been out of use against this pest for the last twenty years.

Table (12) : Susceptibility of field Spodoptera littoralis to DDT compared to a laboratory culture in early and late seasons of 1982.

Strain	Early season				Late season				T for early and late season
	LD_{50} µg/l.	LD_{84} µg/l.	Slope	X^2	LD_{50} µg/l.	LD_{84} µg/l.	Slope	X^2	
Lab.	4.918	21.785	1.55	0.61	4.446	23.414	1.39	0.77	0.49
Sharkia	10.29*	85.09	1.09	2.60	19.91*	320.02	0.83	1.63	2.155*
Gharbia	15.73*	78.90	1.43	3.16	18.62*	111.19	1.29	0.63	0.779
Dakahlia	7.213	41.153	1.32	1.74	8.005*	45.169	1.33	1.90	0.435

* Student "t" significant at p = 0.05

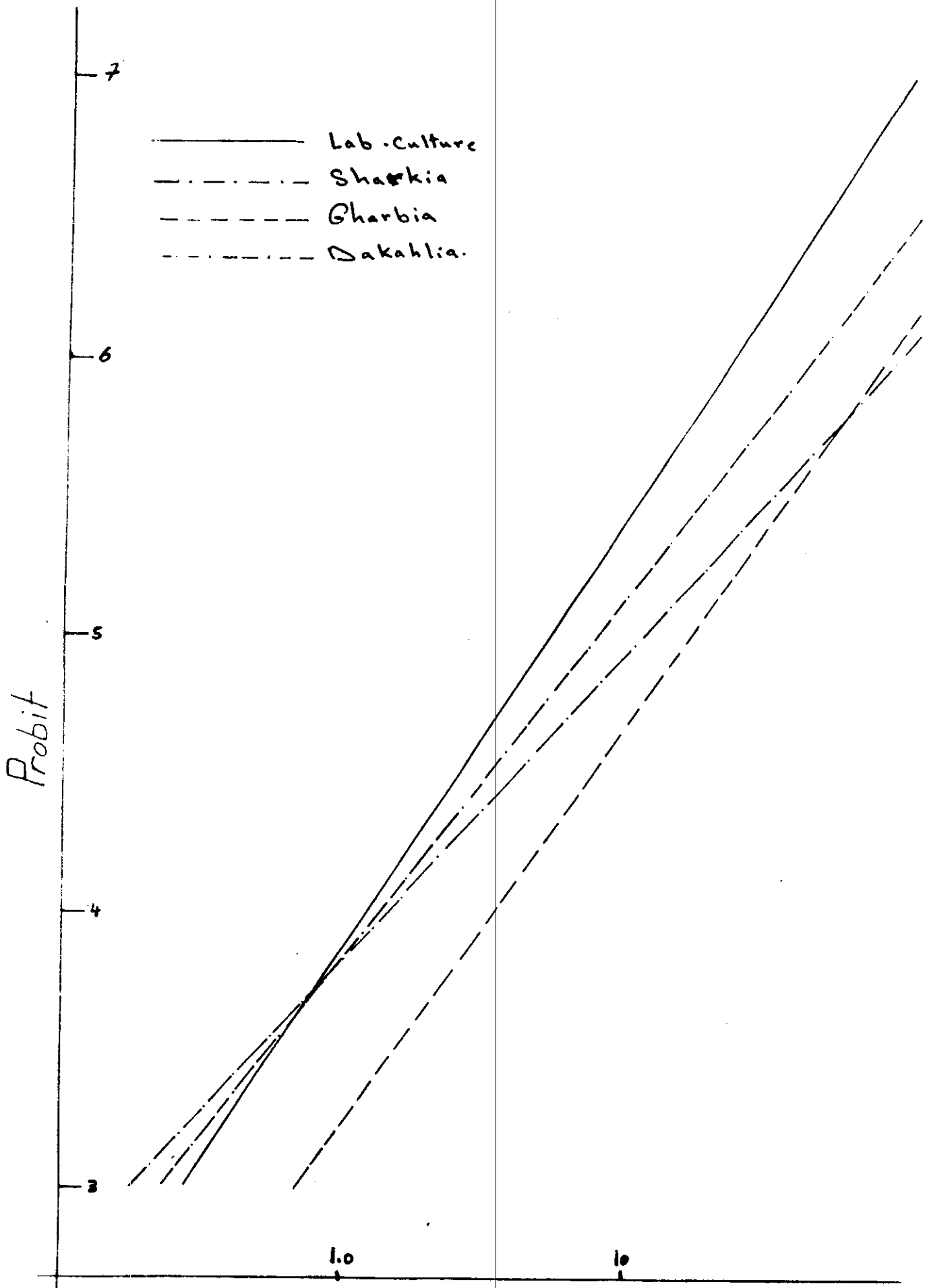

Fig. 18: LD-P lines for the 4th. instar larvae from a laboratory Culture and samples from different governorates treated with DDT.; early season 1982

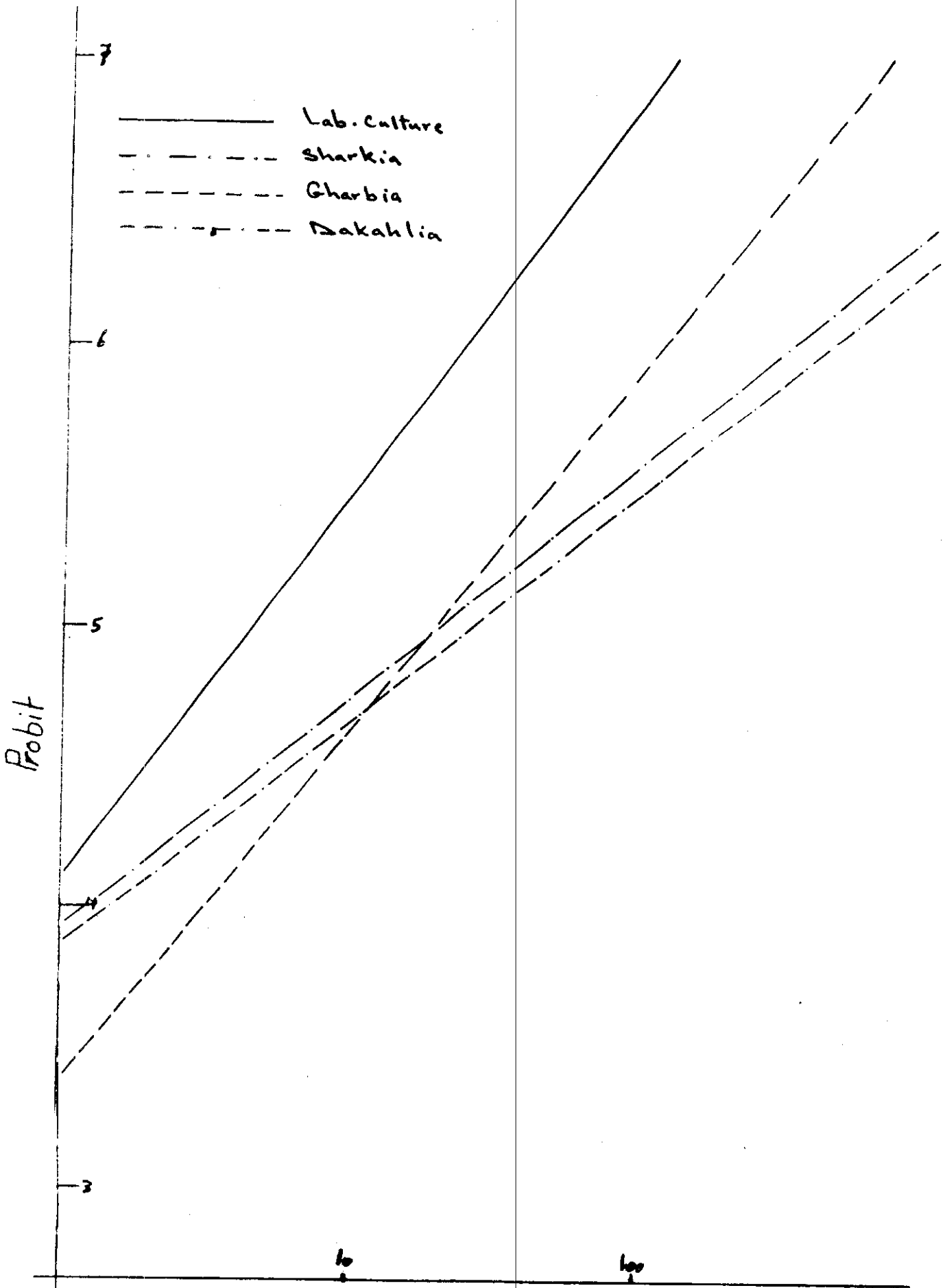

Fig. 19: LD-P lines for 4th. instar larvae from a laboratory culture and samples from different governorates treated with D D T.; late season 1982

Susceptibility of Field Samples to Cypermethrin compared to a Laboratory Culture in Early and Late Season of 1982 :

Results in Table (13) show the values of LD_{50}'s, LD_{84}'s, slope and X^2 in both early and late season in samples from three governorates compared to a laboratory culture examined with cypermethrin. In the tests carried out with early season samples, the LD_{50}'s and LD_{84}'s showed some variations between samples. LD_{50} and LD_{84} for samples from Sharkia were markedly higher than those of the laboratory culture. The LD_{50} for the field sample was 1.43 times higher than that of laboratory culture. On the other hand, the sample from Gharbia, had a value for LD_{50} more or less similar to that of the laboratory culture, while it's LD_{84} value was much lower than the laboratory culture; the difference was 1.52 folds. These differences in the LD_{50} values, however, were not statistically significant.

The susceptibility of the Dakahlia sample was rather exceptional. The LD_{50} value was far below that of the laboratory culture. The latter value was 2.51 times higher than that of the field sample. The LD_{84} value as well was lower in the field sample than the laboratory culture by 1.98-folds.

The slopes of Ld-P lines were more or less similar with the exception of the sample from Gharbia (Fig. 20) which had a considerably higher slope than the rest of the samples, with the consequence that the LD_{84} was much smaller than the laboratory culture. All X^2 values were not significant.

In the late season test, the LD_{50} and LD_{84} for the laboratory culture was more or less the same, while these values for the field samples were higher in comparison with the early season values. As a consequence to these changes, Sharkia sample showed LD_{50} value significantly higher than the laboratory culture; it was 1.66 folds higher than that of the laboratory culture. The value of LD_{50} for Dakahlia in the late season was only slightly lower than that of the laboratory culture, the difference, however, was not statistically significant. The differences between the LD_{50} values for the two seasons were found to be statistically significant in samples from both Gharbia and Dakahlia.

The LD_{84} values were higher in the late season test, this was particularly evident in samples from Gharbia. The slopes did not show any appreciable

differences between the two seasons except in Gharbia, where it lost some of it's steepness, while Dakahlia becâme steeper in the late when compared to the early season. In comparison with the laboratory culture, the slope of the Sharkia sample was similar to the laboratory culture, while that of Gharbia was lower and Dakahlia was higher than the slope for the laboratory culture.

It is evident that the response of cotton leafworm larvae to this insecticide shows a lot of variability from one governorate to another, beside a tendency for less susceptibility in the late season. Dittrich et al. (1979) reported a 13.4 fold level of resistance. The above results and the fact that this insecticide was not very long in use suggest a careful investigation of the probabilities of developing resistance in the cotton leaf worm to this insecticides.

Table (13) : Susceptibility of field Spodoptera littoralis to cypermethrin compared to a laboratory culture in early and late seasons of 1982.

Strain	Early season				Late season				T for early and late season
	LD_{50} µg/l.	LD_{84} µg/l.	Slope	X^2	LD_{50} µg/l.	LD_{84} µg/l.	Slope	X^2	
Lab.	15.94	86.21	1.36	1.94	15.79	88.53	1.41	1.63	0.076
Sharkia	22.80	113.74	1.43	0.98	26.28*	135.20	1.41	1.60	1.05
Gharbia	14.55	56.89	1.69	1.27	24.15	143.77	1.29	2.03	2.22*
Dakahlia	6.360*	43.589	1.20	2.09	13.99	63.08	1.53	0.40	3.08*

* Student "t" significant at p = 0.05

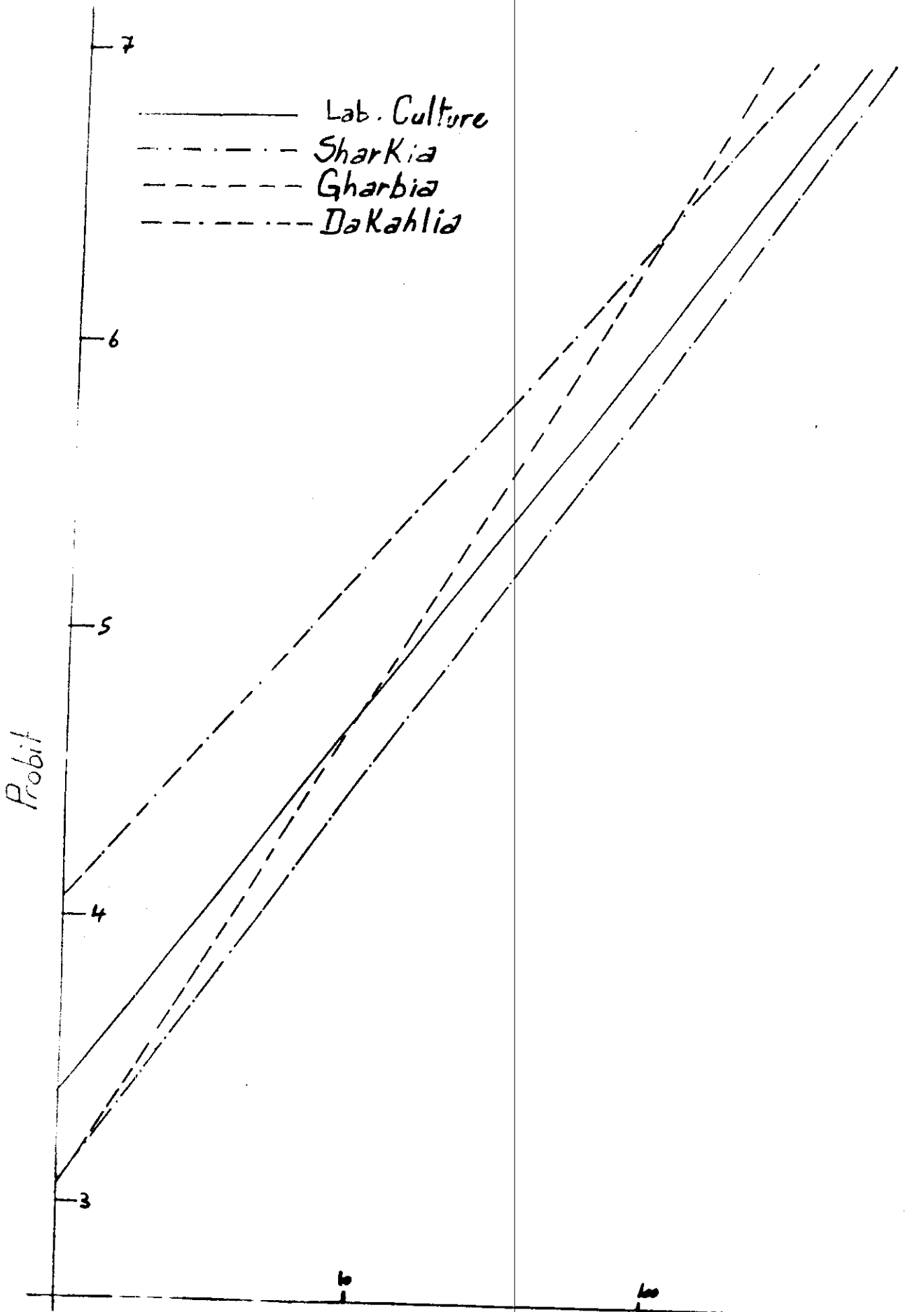

Fig 20: LD_P lines for 4th. instar Larvae from a laboratory culture and samples from different governorates treated with Cypermethrin; early season 1982

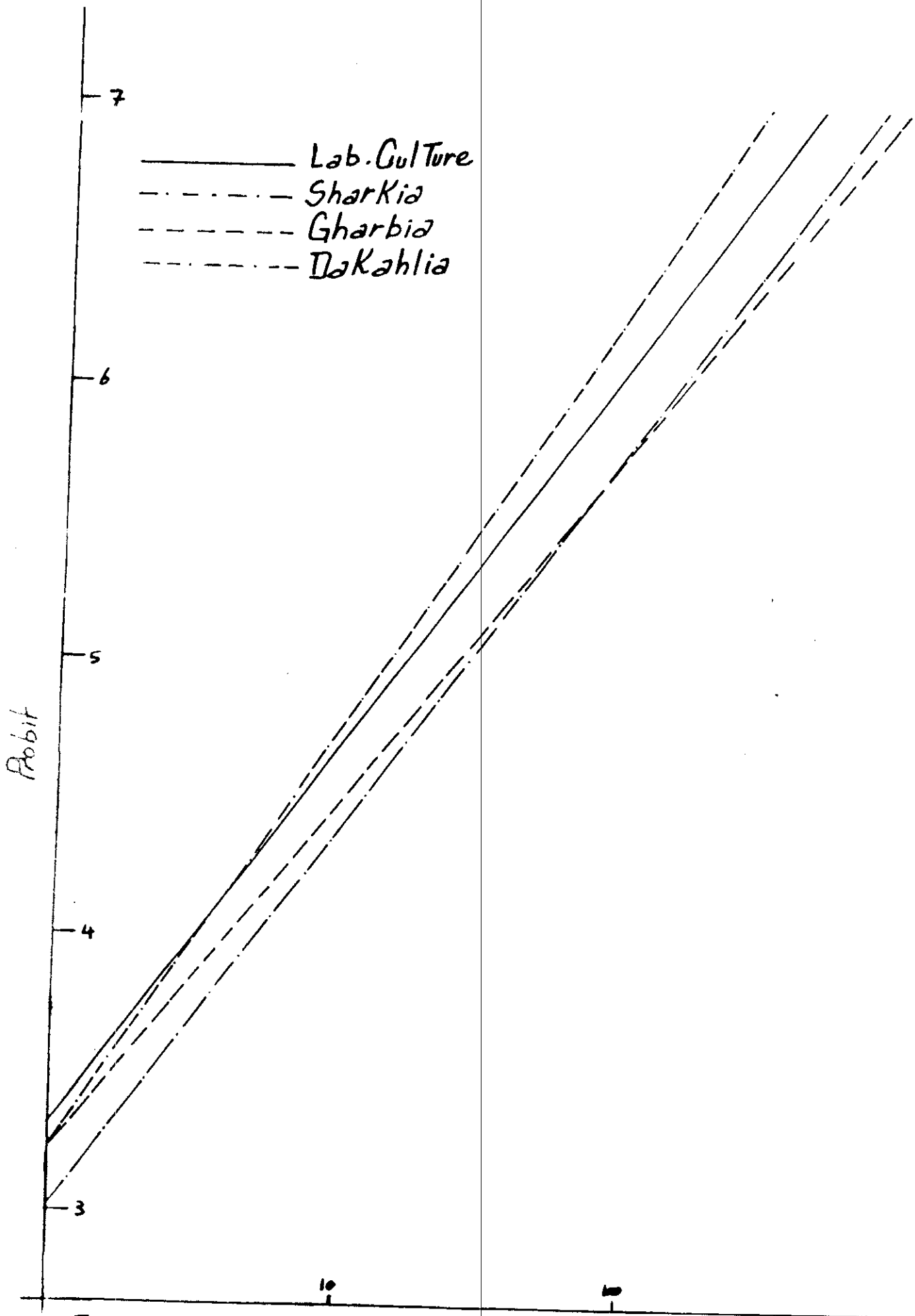

Fig 21: LD_P lines for 4th. instar larvae from a laboratory culture and samples from different governorates treated with Cypermethrin in late season 1982

3. Comparison of 1980 and 1982 Seasons :

Susceptibility of Field Samples to Profenofos Compared to a Laboratory Culture in Early and Late Season of 1980 and 1982 :

Data tabulated in Table (14) show the LD_{50} values for profenofos in the years 1980 and 1982 for the early season and late season samples. It is noticed that the differences were very small in the case of laboratory culture as well as the Sharkia and Gharbia samples. In Dakahlia, there was a marked difference between the data for the years 1980 and 1982.

The LD_{50} for the early season in 1982 was 1.69 times higher than that of 1980, while it was in the late season of 1982 1.89 folds higher than that of 1980. The differences were statistically significant. These figures would suggest that probabilities of developing tolerance to this toxicant are to be looked for in the Dakahlia governorate.

Table (14) : Susceptibility of field strains to profenofos compared with a laboratory strain in early and late seasons 1980 and 1982.

	Early			Late		
	LD_{50} kg/larva		T			T
	1980	1982		1980	1982	
Lab. culture	0.275	0.254	0.258	0.258	0.276	0.41
Sharkia	0.221	0.249	0.686	0.290	0.271	0.4
Gharbia	0.200	0.193	0.176	0.294	0.357	0.95
Dakahlia	0.266	0.451	2.070*	0.305	0.554	2.463*

* Student "t" significant at p = 0.05

Susceptibility of Field Samples to Chlorpyrifos compared to a Laboratory Culture in Early and Late Season of 1980 and 1982 :

Results in Table (15) show the values of LD_{50} for chlorpyrifos for laboratory culture and the field samples in both early and late seasons for both the years 1980 and 1982.

It is clear that there was a slight difference between LD_{50} values in both above mentioned two years. Statistical analysis revealed absence of any significance between these differences. This may be taken to indicate that so far S. littoralis did not show any tendency to tolerance towards this insecticide.

Table (15) : Susceptibility of field strains to chlorpyrifos compared with a laboratory strain in early and late seasons 1980 and 1982.

	Early			Late		
	LD50 µg/larva		T			T
	1980	1982		1980	1982	
Lab. culture	0.192	0.159	0.8415	0.205	0.166	1.13
Sharkia	0.268	0.288	0.626	0.309	0.433	1.4
Gharbia	0.274	0.298	0.403	0.302	0.407	1.21
Dakahlia	0.256	0.402	1.0973	0.430	0.483	0.466

Susceptibility of Field Samples to Monocrotofos Compared to a Laboratory Culture in Early and Late Seasons of 1980 and 1982 :

It is clear from results listed in Table (16) that the figures from the year 1982 were higher than those of 1980 in laboratory and field samples.

The LD_{50} values for early season of 1982 were 1.35, 1.53, 1.69 and 1.67 folds higher than those of 1980 in the laboratory, Sharkia, Gharbia and Dakahlia respectively. These proportions from the late season were 1.30, 1.39, 1.78 and 1.38 for the above mentioned four samples respectively.

Results also revealed that these differences were not statistically significant (Table, 16).

Table (16) : Susceptibility of field strains to monocrotofos compared with a laboratory strain in early and late seasons 1980 and 1982.

	Early		LD_{50} µg /Larva T	Late		T
	1980	1982		1980	1982	
Lab. culture	5.007	6.737	0.984	5.201	6.828	0.88
Sharkia	5.857	8.955	1.462	7.235	10.08	1.10
Gharbia	5.042	8.528	1.5346	5.801	10.35	1.90
Dakahlia	3.612	6.032	1.328	4.293	5.942	0.9477

III. Effect of Sub-lethal Doses of Different Insecticides on 4th Instar Larvae of Spodoptera littoralis :

1. Effect on moulting to 6th instar larvae :

Two hundred 4th instar larvae surviving after treatment with sublethal doses of different insecticides, were divided into five replicates of 40 larvae each and the number reaching the 6th instar was recorded. Results in Table (17) show that in all cases the percentage of larvae reaching successfuly the 6th instar was less than that of control. The figures obtained were subjected to analysis of variance. It was found that the differences in latent mortalities between the different treatments and control was not significant with the exception of monocrotofos, where the difference was significant at $p = 0.05$. Such latent mortalities were reported (Nageib, 1984).

2. Effect on pupation :

No appreciable differences were noticed between pupae produced from previous treatment and control. Analysis of variances revealed the absence of significant differences either between treatments and

control or between the treatments of different insecticides (Table, 17).

3. Effect on adult emergence :

Results in Table (17) show the percentage of the emergence of adults from pupae formed from larvae receiving sublethal doses of insecticides. The percentage of emergence was highest in untreated control. In other treatments, the percentage was slightly lower, the lowest was that of treatment with profenofos, followed by DDT, while those of chlorpyrifos, monocrotofos and cypermethrin were more or less similar. Analysis of variance, however, revealed that the differences were not statistically significant. With the exception of profenofos treatments, there was a slight increase in number of eggs per female in all other treatments and control.

This increase was highest in chlorpyrifos treated larvae followed by cypermethrin. The number of eggs laid by adults from larvae pre-treated with monocrotofos and DDT was more or less the same, while there was a slight drop in the number of eggs from the profenofos treatment. All these differences, however, were not statistically significant.

Increases in egg oviposition after exposure to sublethal doses were reported by Locher (1958) and Abdel-Salam and Nasr (1967). On other hand, reports about the decreases in oviposition was reported by Loschiavo (1980 , El-Deeb et al(1980) and El Nahal and El-Halfawy (1973 a & b) . It appears that the doses used in this work had no effect on the oviposition rate of the female adults of Spodoptera littoralis.

4. Effect on egg hatchability:

Results in Table (17) show that there was a reduction in the percentage of egg hatchability in all treatment in comparison with the untreated control. The largest reduction was that observed with monocrotofos , followed byDDT. Hatchability was more of less similar in both profenofos and chlorpyrifos. The least reduction was that observed in treatments of cypermethrin.

All these differences, however were not statistically significant.

Table (17) : Effect of sub-lethal doses of different insecticides on larvae of Spodoptera littoralis.

Insecticides	Initial No. of larvae L_4	Successful moult to 6th instar		Pupation			No. of pupae	Adult emergene		No.of eggs/ female	% Hatc-hing
		No.of larvae	%	No.of pupae	No.of pupae	%		No. of adults	%		
Profenofos	200	142	71	100	90	90	100	90	90	1146	66.2
Chlorpyrifos	200	148	74	100	97	97	100	95	95	1685	65.6
Monocrotofos	200	132	66 *	100	98	98	100	96	96	1388	57.6
DDT	200	150	75	100	98	98	100	93	93	1398	61.8
Cypermethrin	200	152	76	100	100	100	100	95	95	1438	70.0
Control	200	194	97	100	97	97	100	98	98	1291	77.4

IV. Effect of Sub-lethal Doses on Adults of Spodoptera littoralis

60 pairs of adults surviving after sublethal doses of toxicants were allowed to copulate and lay eggs and the number of eggs per female, hatchability and successful ecdysis of larvae from first to second instar were recorded (Table ,18).

1. Effect on the number of eggs laid/female :

Results tabulated in Table (18) show the number of eggs laid per treated female. In all treatments, the number of eggs laid per female were decreased.

The percentages of decrease were 64.7, 52.5, 50.2, 12.7 and 10.36 in the case of cypermethrin, DDT, monocrotofos, profenofos and chlorpyrifos respectively. The percentages of decrease were significantly different in the case of monocrotofos, DDT, and cypermethrin, while there was no significant difference between profenofos and chlorpyrifos.

2. Effect on egg hatchability :

The side effects of insecticides on egg hatchability was very clear. In all treatments;the

percentages of hatchability were highly decreased, while it was 66.5 % in the case of untreated, it was 20.4, 19.9, 9.7, 6.4 and 3.39 for chlorpyrifos, profenofos, DDT, monocrotofos and cypermethrin treatments, respectively.

Statistical analysis showed that the reduction in hatchability was statistically significant in all cases. These results agree with the finding of El-Nahal et al. (1973) who reported a decrease in fertility of Sitophilus oryzae and S. granaria after treatment with sublethal doses of pyrethrins and inert dusts.

3. Effect on moulting from first instar larvae to second instar larvae :

Results in Table (18) show that most of the first instar larvae succeeded to moult to the second instar. The percentage of moulting varied between 86-96.5 % in all treatment, while it was 98.7 % in the control.

Statistical analysis proved that there are no significant difference between treatments and control.

Table (18) : Effect of sub-lethal doses of different insecticides on adults of Spodoptera littoralis.

Insecticides	No.of treated adults in pairs	Total eggs/ female	% Decre-ase	Hatching %			Moulting from L_1 to L_2		
				Total eggs/ 12 fem.	Total Hatch/ 12 fem.	% Hatch-ing	No.of L_1	No.of L_2	% Moult-ing
Profenofos	60	623	12.7	37451	7458	19.9*	1696	1621	95.5
Chlorpyrifos	60	640	10.36	30933	6340	20.4*	1481	1329	89.7
Monocrotofos	60	355	50.2*	21297	1360	6.4*	960	864	90.0
DDT	60	336	52.5*	20151	1960	9.72*	831	736	88.5
Cypermethrin	60	252	64.7*	15132	517	3.39*	497	428	86.0
Control	60	714		42861	28509	66.515	1912	1889	98.7