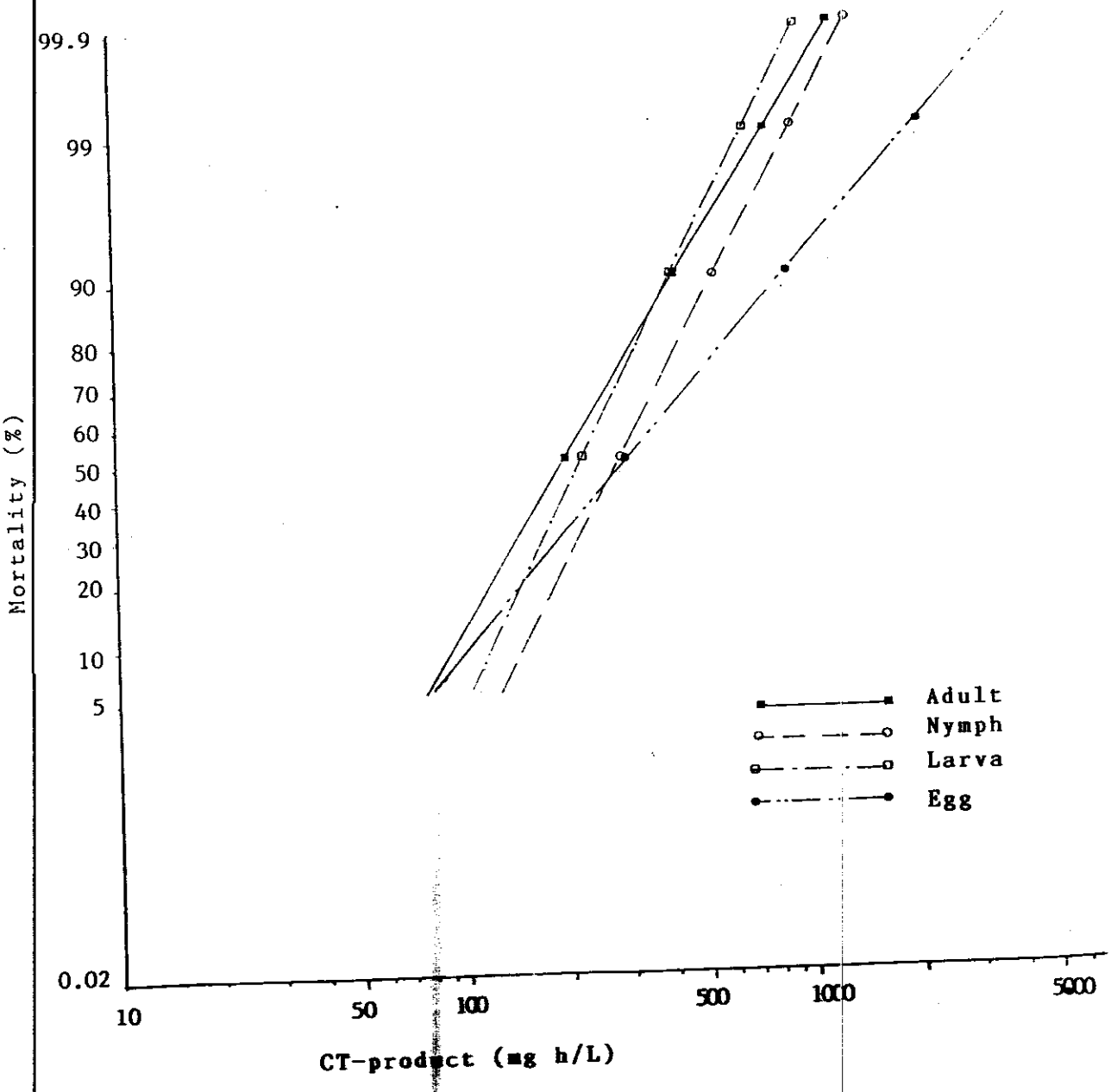

Fig. (18): Lethal response of A. siro L., exposed to an increasing concentration of phosphine and varying exposure periods at 6±1°C and 80±5% r.h.

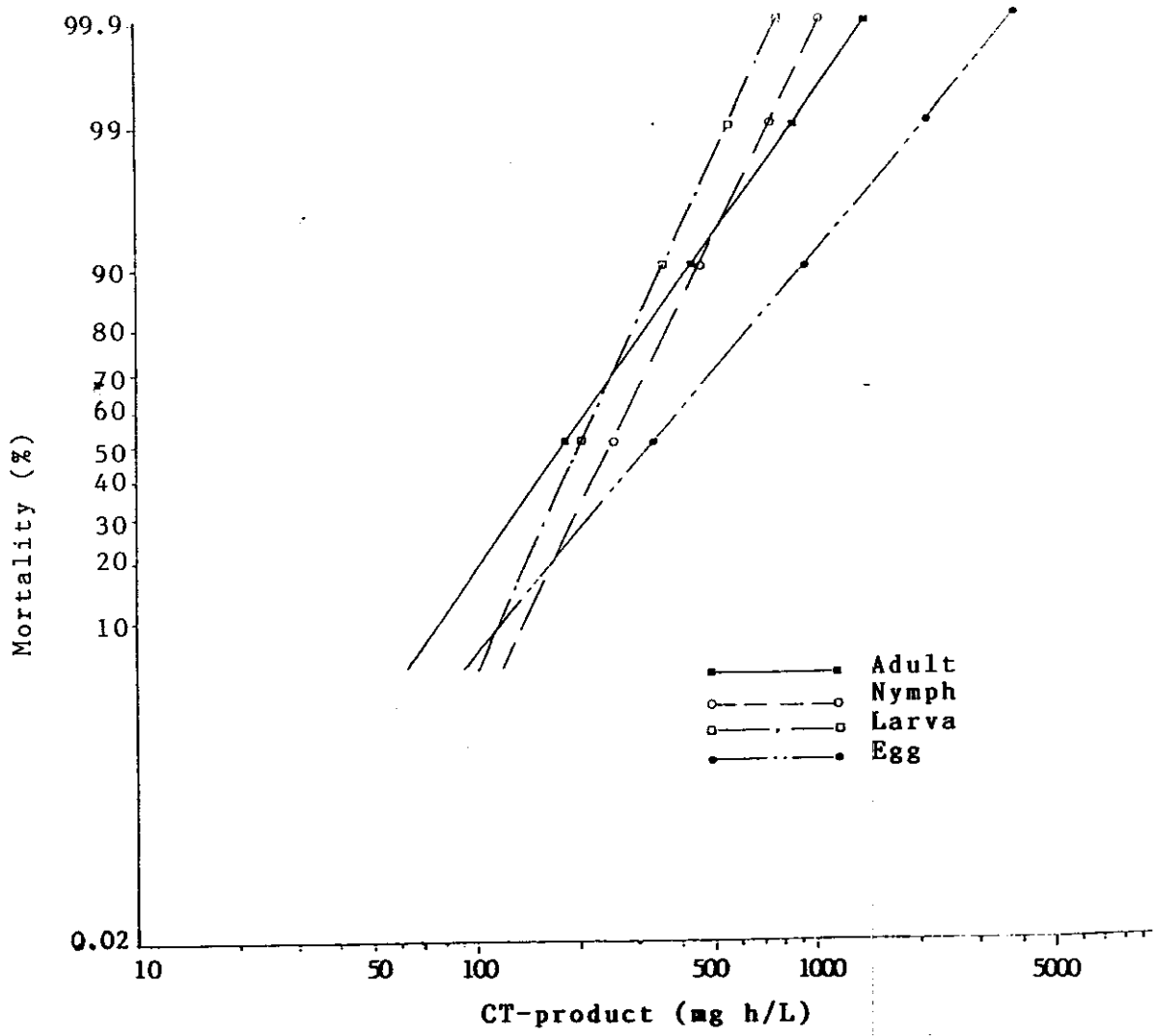

Fig. (19): Lethal response of T. putrescentiae (Schrank), exposed to an increasing concentration of phosphine and varying exposure periods at 6±1°C and 80±5% r.h.

Data indicate that the CT-product values required to achieve 90% kill for the adult, nymphal, larval and egg stages of A. siro at 6±1°C were 411, 540, 405 and 860 mgh/L respectively.

The corresponding values for the various stages of T. putrescentiae were 428, 453, 354 and 926 respectively.

Results proved that the eggs were the most tolerant stage at the two test temperatures and phosphine was less effective at 6±1°C than at 23±1°C. Phosphine was more effective at long exposures than at short exposures.

Data indicate also that the CT-products needed for a certain mortality by using the increasing concentration of 5.8 mg/L, were greater than that obtained by using the fixed concentration of 0.85 mg/L at both test temperatures. The results are in agreement with the findings obtained by other authors on insects (Vincent and Lindgren, 1972; Howe, 1973; Muthu, 1973; Reynolds et al., 1967; Barker, 1969; Brown et al., 1969; Bell and Glanville, 1973; Barbara et al., 1976 and Bowley and Bell, 1981).

4.1.2. Toxicity of phosphine to Gobieria fusca (Oudemans) and Chortoglyphus arcuatus (Troupeau):

The effect of phosphine against G. fusca and Ch. arcuatus was investigated at 23±1°C. Data obtained were

tabulated in Table (6) and illustrated in Figures (20 and 21).

Results showed that the CT-product values required to achieve 90% kill for the adults, nymphs and larvae of G. fusca were 47, 72 and 55 mgh/L respectively.

The corresponding values for the adult, nymphal and larval stages of Ch. arcuatus were 102, 107 and 72 mgh/L respectively.

The $LC.T_{99.9}$-values were 186, 141 and 229 mgh/L for the adult, nymphal and larval stages of G. fusca respectively.

The corresponding values were 539, 438 and 385 mgh/L for the adult, nymphal and larval stages of Ch. arcuatus respectively.

It is clear from the results obtained here, that the mobile stages of G. fusca were more susceptible to phosphine than the mobile stages of Ch. arcuatus, because adult female of G. fusca possess a pair of well-developed tracheae and each branches into an anterior region which expands into an air sac.

Bond et al. (1967, 1969) found that oxygen was essential for phosphine to exert a toxic effect.

Nakakita et al. (1975) also related the toxicity of phosphine to respiration of insects, observing narcosis at high concentrations, while Bang and Telford (1966) regarded phosphine as a narcotic in studies on the relationship between mortality and oxygen consumption.

Table (6): Lethal CT-product and parameters of probit regression line estimates of Gohieria fusca (Oudemans) and Chortoglyphus arcuatus (Troupeau), exposed to an increasing concentration of phosphine (max. conc. = 5.8 mg/L after 24 hr) and varying exposure periods (4, 6, 8, 10, 12, 14, 16, 18, 20, and 24 hr) at 23±1°C and 80±5% r.h.

Mite species and stages	CT-product (mgh/L)				Parameters of regression line		Degree of freedom	R	95% confidince limits at							
	LCT_{50}	LCT_{90}	LCT_{99}	$LCT_{99.9}$	Slope ± S.E.	a			LCT_{50} Lower	LCT_{50} Upper	LCT_{90} Lower	LCT_{90} Upper	LCT_{99} Lower	LCT_{99} Upper	$LCT_{99.9}$ Lower	$LCT_{99.9}$ Upper
G. fusca (Oudemans)																
Adult	17.8	47.0	104.2	186.4	3.03 ± 2.21	1.22	8	0.940	16.3	19.5	41.4	53.3	85.3	127.2	143.8	241.5
Nymph	31.4	71.5	90.5	140.7	5.56 ± 2.22	-0.33	8	0.846	28.9	34.0	65.1	78.7	81.0	101.1	121.7	162.6
Larva	20.2	55.1	125.5	229.0	2.93 ± 1.96	1.18	8	0.887	18.5	22.1	48.3	62.9	101.5	155.1	173.8	301.8
Ch. arcuatus (Troupeau)																
Adult	31.8	102.4	267.3	539.0	2.51 ± 0.72	1.23	8	0.968	28.8	35.2	84.6	123.9	196.6	363.5	362.4	801.8
Nymph	39.8	107.2	241.7	437.8	2.96 ± 1.44	0.26	7	0.765	36.3	43.7	93.0	123.5	192.5	303.4	325.8	588.3
Larva	22.1	71.9	189.4	384.5	2.48 ± 1.37	1.66	8	0.941	19.9	24.5	60.8	85.1	144.1	249.1	269.1	549.3

S.E. = Standard error of regression line.

a = Axis intercept of regression line.

R = Correlation coefficient of regression line.

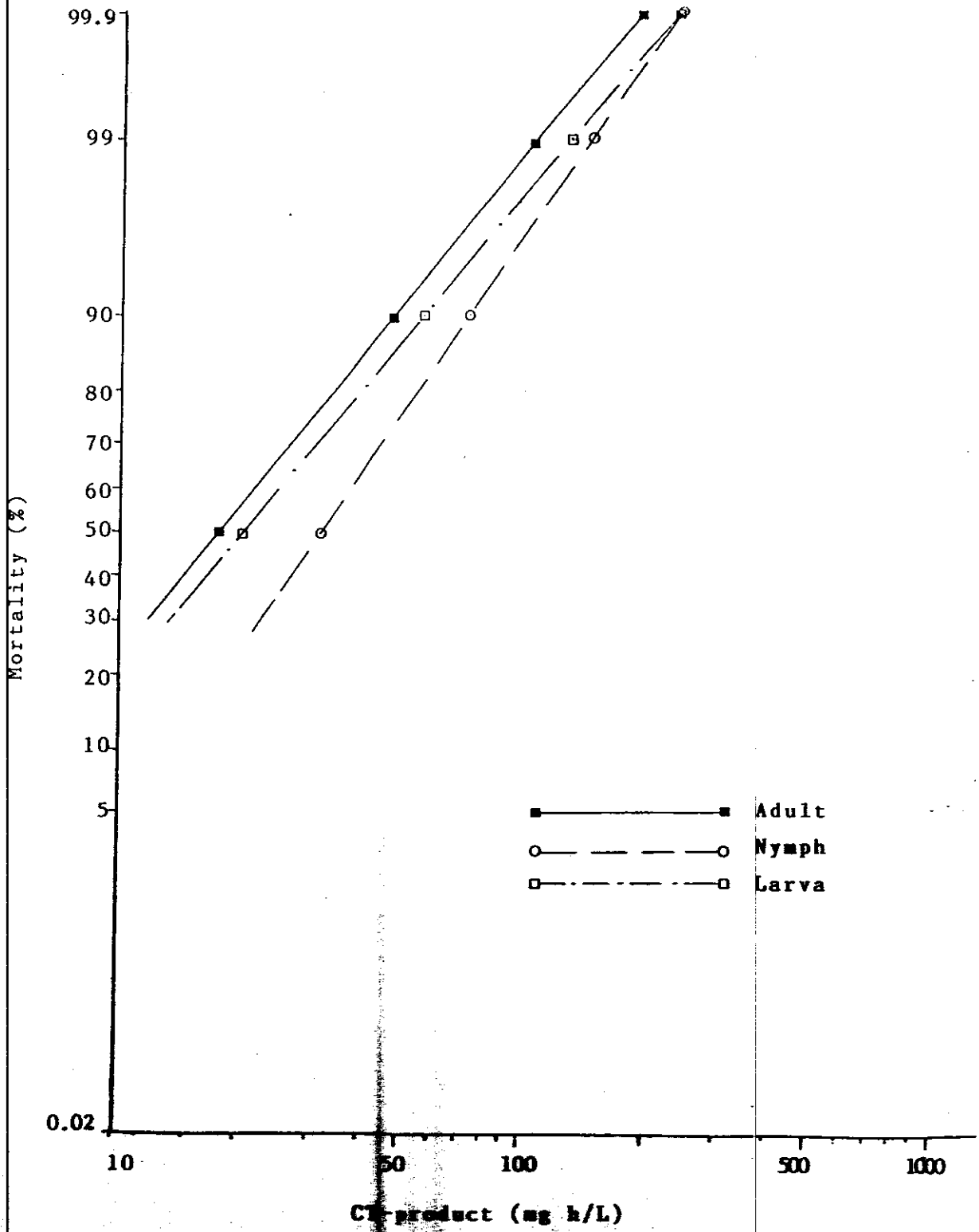

Fig. (20): Lethal response of [illegible] fusca (Oudemans), exposed to an increasing concentration of phosphine and varying exposure periods at 23±1°C and 80±5% r.h.

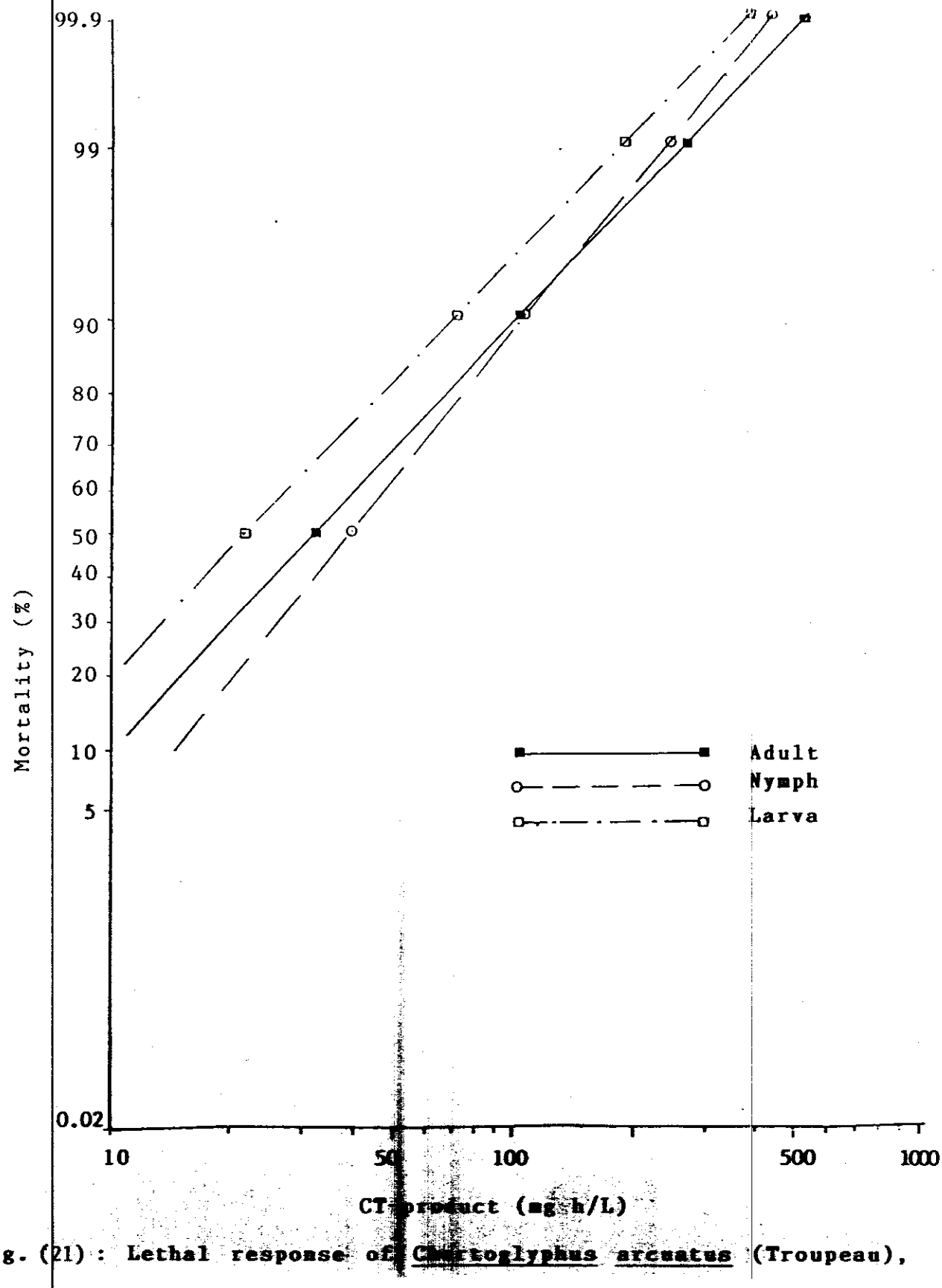

Fig. (21) : Lethal response of Cheyletoglyphus arcuatus (Troupeau), exposed to an increasing concentration of phosphine and varying exposure periods at 23±1°C and 80±5% r.h.

As can be seen from the results recorded here, phosphine was markedly less effective at lower temperature, at which the metabolic rate of mites is lower and oxygen consumption is reduced.

The tolerance of eggs of A. siro and T. putrescentiae to phosphine was very high. This result is similar to that obtained by Amaro (1963).

4.2. **Some biological observations on the survivors of A. siro L, exposed to the median lethal dose of phosphine:**

The biological characteristics of the survivors of A. siro, exposed to the median lethal dose of phosphine, were studied in the laboratory at 26°C and 85±5% r.h. in comparison to that of the untreated population (parents).

Results achieved were illustrated in Tables (7 and 8) and Figure (22).

It was found that there was no significant difference between the survivors and the untreated population in the average pre-oviposition period, average number of eggs laid per female per day, average hatching rate, average incubation period, average duration of larval instar, average duration of nymphal instars, total developmental period, larval and nymphal mortalities and emergence rate of adults (Table, 7).

Table (7): Some biological parameters for the parents and the survivors of Acarus siro L. reared at 26°C and 85±5% r.h.

Parameters	Parents	Survivors	Probability
Average pre-oviposion period (day)	1.167 ± 0.543	1.167 ± 0.542	1.000
Average number of eggs per female/day	5.360 ± 1.380	5.040 ± 0.780	0.846
Total No. of eggs per female during 12 days	64.200 ±16.730	60.800 ± 9.520	0.864
Average hatching rate %	100	100	-
Average incubation period (days)	2.833 ± 0.1666	2.333 ± 0.333	0.209
Average total duration of larval instars (days)	1.833 ± 0.666	2.000 ± 0.000	0.341
Average duration of nymphal instars (day) for:			
Protonymph	1.667 ± 0.211	1.667 ± 0.211	1.000
Deutonymph	1.500 ± 0.224	1.667 ± 0.211	0.599
Tritonymph	2.000 ± 0.258	2.000 ± 0.258	1.000
Total development period (days)	9.830 ± 0.477	9.670 ± 0.666	0.843
% mortality for nymphal instars	0.00	0.00	-
% mortality for larval instars	0.00	0.00	-
Emergence rate %	100	100	-

Table (8): Average number of daily eggs, laid per female during 12 days for the parents and the survivors of *Acarus siro* L. at 26°C and 85±5% r.h.

Days	Average number of eggs, laid per female		
	Parent	Survivors	Probability
1 st day	7.6 ± 3.72	7.0 ± 1.55	0.885
2 nd day	4.4 ± 1.36	17.0 ± 4.05	0.018*
3 rd day	0.0 ± 0.00	3.8 ± 2.42	0.155
4 th day	3.0 ± 1.89	2.8 ± 1.53	0.936
5 th day	2.2 ± 2.20	3.6 ± 1.83	0.638
6 th day	6.2 ± 2.59	2.8 ± 2.56	0.378
7 th day	14.6 ± 2.74	3.8 ± 1.56	0.103
8 th day	7.0 ± 2.74	3.2 ± 1.66	0.269
9 th day	5.8 ± 2.59	2.6 ± 1.03	0.285
10 th day	2.6 ± 1.11	3.8 ± 1.74	0.574
11 th day	5.4 ± 2.48	8.2 ± 1.74	0.538
12 th day	5.4 ± 2.16	2.2 ± 1.32	0.242
Average total number of eggs per day	**5.36 ± 1.38**	**5.04 ± 0.78**	**0.846**
Average total number of eggs laid during 12 days	**64.2 ± 16.73**	**60.8 ± 9.52**	**0.864**

*** = Difference is significant at 5% level.**

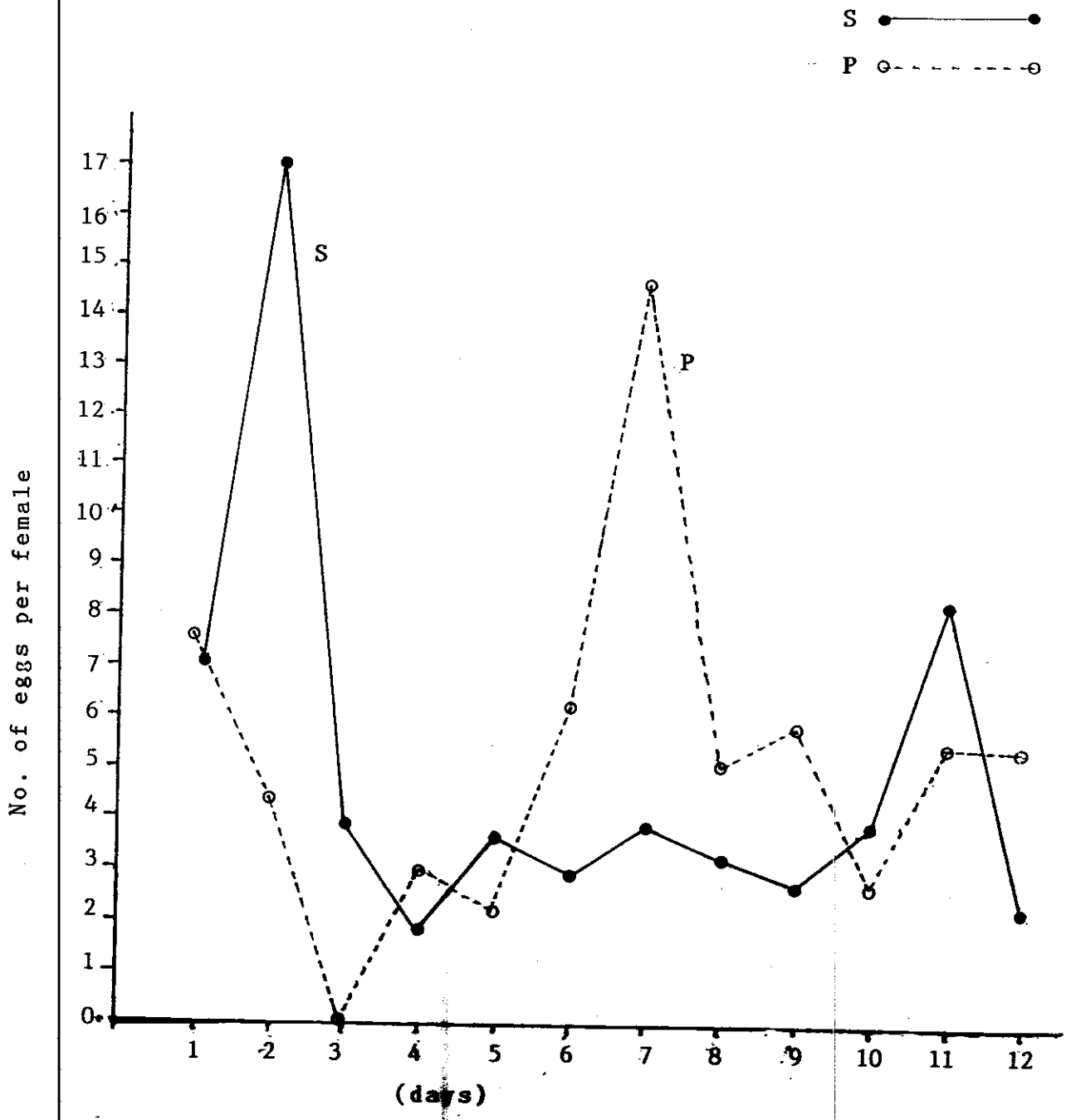

Fig. (22): Comparative average number of daily eggs, laid per adult female for the parents (P) and the survivors (S) of Acarus siro L. treated with the median lethal dose of phosphine.