RESULTS

RESULTS

Virulence of the studied entomopathogenic fungi (supernatant) against newly hatched larvae of *Pectinophora gossypiella*:-

For studying the virulence of entomopathogenic fungi on the pink bollworm, artificial diet immersed in different concentrations of supernatant were used.

Data in table (1, 2, 3, 4, 5) show that the mortality percentage in the newly hatched larvae of *P.gossypiella* increased with increasing the time elapsed after treatment.

For *M. anisopliae* (Table: 1 and Fig: 1) the mortality percentage after two days of treatment was 22.12, 16.22 and 32.77% for the concentration 40, 60 and concentration 80 respectively.

After 3 days of treatment, the mortality percentage was 32.40,29.35 and 48.60% then ranged between 40.70-60.13%, 47.46-68.55%, 53.04-74.79%, 57.73-79.51, 61.70-83.14% and 65.10-85.97% after 4,5,6,7,8 and 9 days for the same concentrations mentioned above respectively.

Table(1): Cummulative mortality percentage of *P.gossypiella* newly hatched larvae after feeding on artificial diet immersed in different concentrations of *M.anisopliae* supernatant.

Protein conc. (%)	% of cummulative mortality during 2-9 days after treatment with supernatant							
	2	3	4	5	6	7	8	9
40	22.12	32.40	40.70	47.46	53.04	57.73	61.70	65.10
60	16.22	29.35	40.93	50.55	58.42	64.83	70.07	74.37
80	32.77	48.60	60.13	68.55	74.79	79.51	83.14	85.97

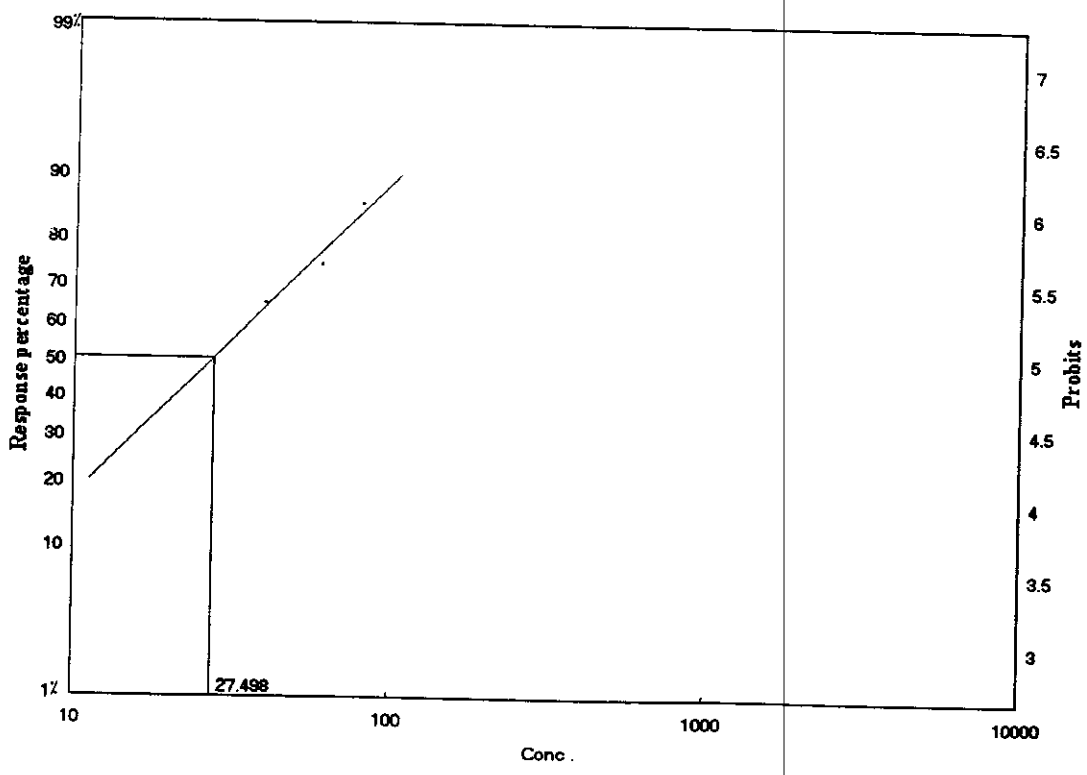

Fig.(1):Toxicity regression line of *M.anisopliae* against newly hatched larvae of *P.gossypiella* after nine days of treatment

Regarding *M. flavovridae* (Table: 2 and Fig: 2) the mortality percentage after 2 days of treatment was 12.81, 6.27 and 6.14% for the concentration 40,60 and 80 respectively, after 3 days the mortality percentage was 22.82, 16.11 and 16.13% for the same concentration mentioned above, then gradual increase in mortality percentage appeared with increasing time elapsed post treatment. The mortality percentage ranged between 62.27-69.56 %after 9 days.

Table(2):Cummulative mortality percentage of *P.gossypiella* newly hatched larvae after feeding on artificial diet immersed in different concentrations of *M.flavovridae* supernatant.

Protein conc. (%)	% of cummulative mortality during 2-9 days after treatment with supernatant							
	2	3	4	5	6	7	8	9
40	12.81	22.82	31.99	40.01	46.90	52.82	57.89	62.27
60	6.27	16.11	27.27	37.98	47.53	55.74	62.66	68.46
80	6.14	16.13	27.56	38.55	48.32	56.69	63.71	69.56

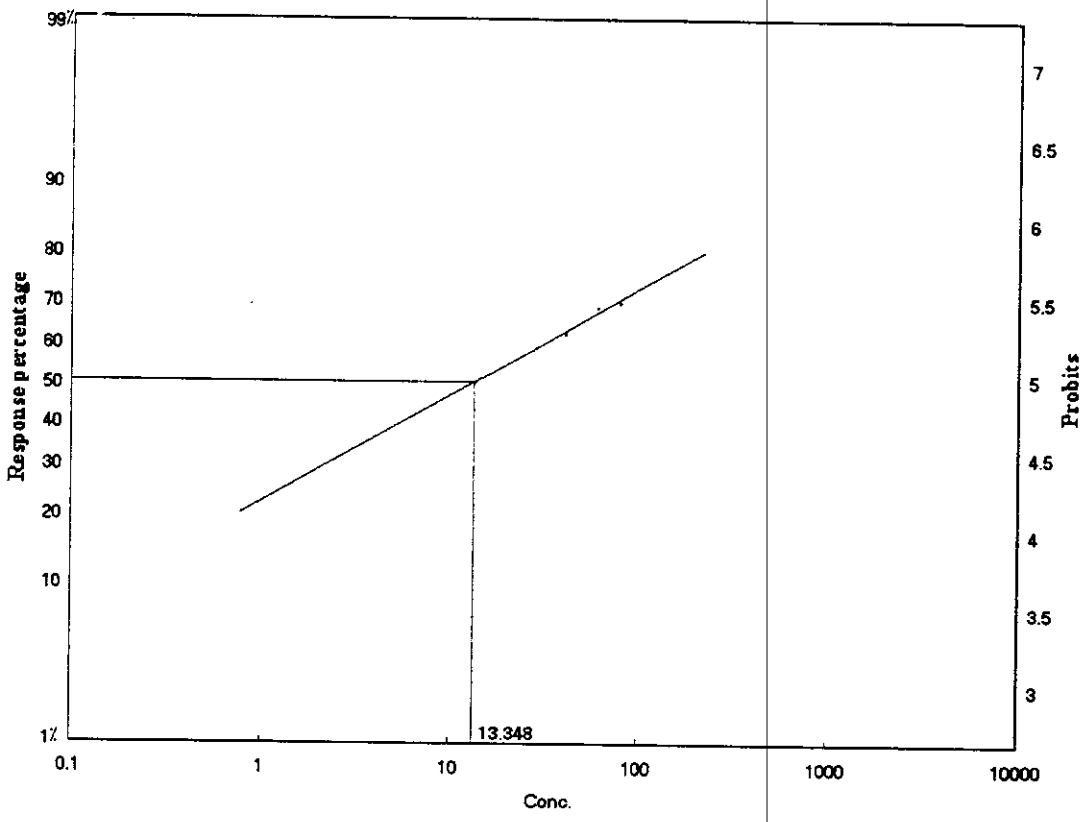

Fig.(2):Toxicity regression line of *M.flavovridae* against newly hatched larvae of *P.gossypiella* after nine days of treatment

As for *P.farinosus*(Table: 3 and Fig: 3) after 2 days the mortality percentage was 6.53, 15.03 and 28.27% for the concentration 40, 60 and concentration 80 respectively. After 3 days the mortality percentage was 16.10, 26.64 and 39.92% for the same concentration mentioned above. There were increasing in mortality percentage from 4^{th} to 9^{th} days ranged between 26.75-48.85 %, 36.94-55.84 %, 46.05-61.43 %, 53.95-65.98%, 60.67-69.75 % and 66.36-72.90 % for the same concentrations mentioned above.

Table(3):Cummulative mortality percentage of *P.gossypiella* newly hatched larvae after feeding on artificial diet immersed in different concentrations of *P.farinosus* supernatant.

Protein conc. (%)	% of cummulative mortality during 2-9 days after treatment with supernatant							
	2	3	4	5	6	7	8	9
40	6.53	16.10	26.75	36.94	46.05	53.95	60.67	66.36
60	15.03	26.64	37.00	45.80	53.16	59.32	64.48	68.82
80	28.27	39.92	48.85	55.84	61.43	65.98	69.75	72.90

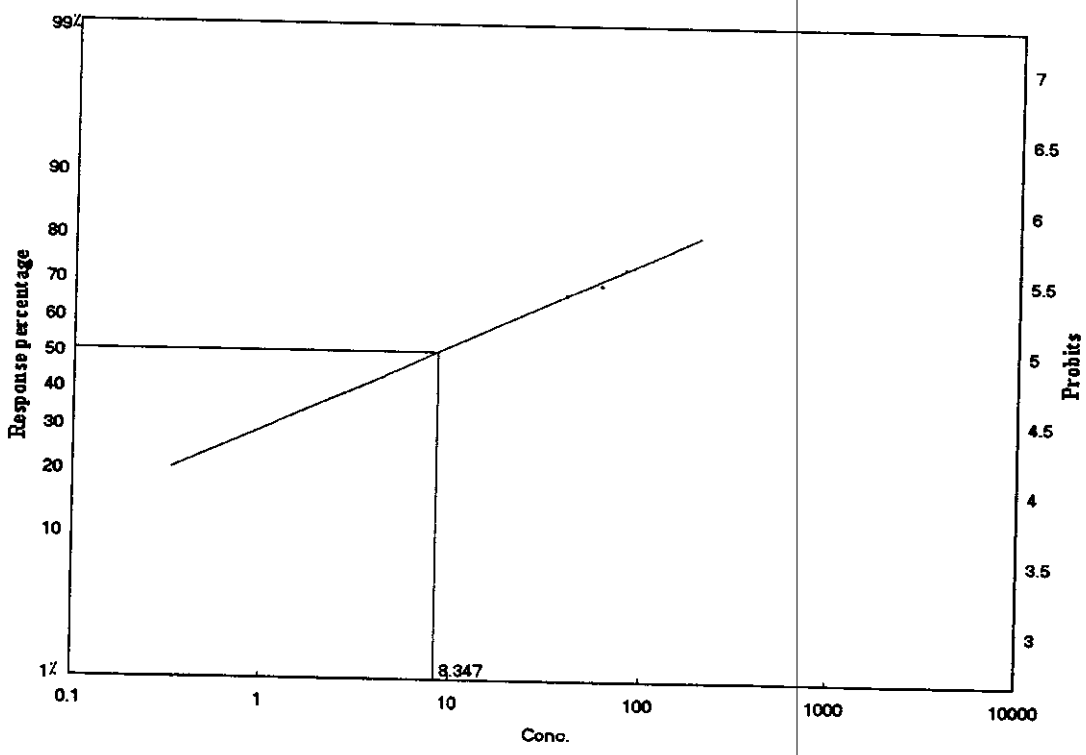

Fig.(3):Toxicity regression line of *P. farinosus* against newly hatched larvae of *P.gossypiella* after nine days of treatment

As well as *B. bassiana* (Table: 4 and Fig: 4) the mortality percentage after 2 days of treatment was 27.18, 26.37 and 29.98% for the concentration 40, 60 and 80 respectively. The mortality percentage reached 70% after 9 days in case of concentration 40, generally it ranged between 38.34 - 42.43 %, 46.96 - 51.83%, 53.77 - 59.09 %, 59.27-64.80%,63.78 - 69.39 %, 67.54 - 73.14% and 70.72 - 76.24% after 3,4,5,6,7,8 and 9 days.

Table(4):Cummulative mortality percentage of *P.gossypiella* newly hatched larvae after feeding on artificial diet immersed in different concentrations of *B. bassiana* supernatant.

Protein conc. (%)	% of cummulative mortality during 2-9 days after treatment with supernatant							
	2	3	4	5	6	7	8	9
40	27.18	38.34	46.96	53.77	59.27	63.78	67.54	70.72
60	26.37	39.34	49.45	57.34	63.59	68.62	72.71	76.09
80	29.98	42.43	51.83	59.09	64.80	69.39	73.14	76.24

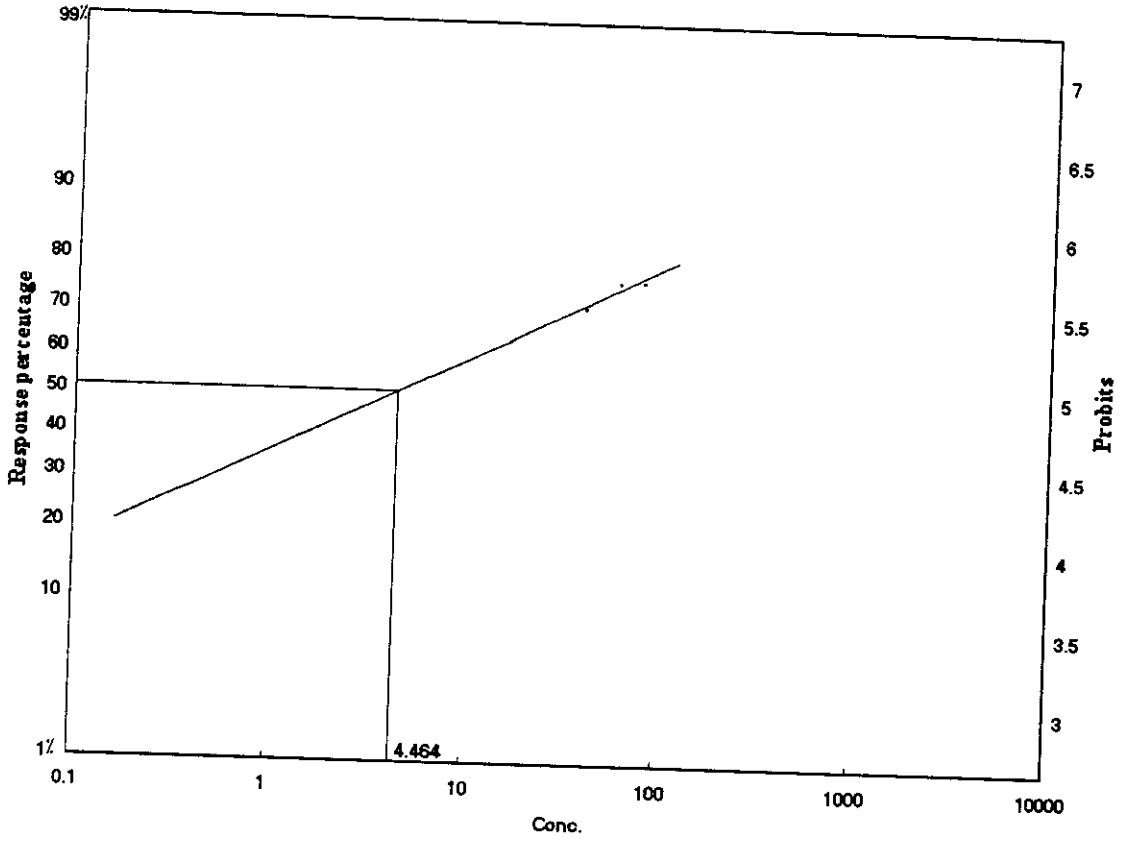

Fig. (4):Toxicity regression line of *B.bassiana* against newly hatched larvae of *P. gossypiella* after nine days of treatment

In addition to the mortality percentage of *B. brongniartii* (Table: 5 and Fig: 5) after 2 days was 17.20, 36.71 and 27.53% for the concentration 40, 60 and 80 respectively. After 3 days of treatment, the mortality percentage was 23.06, 41.99 and 36.47% for the same concentration mentioned above. After 4 days the mortality percentage was 27.36, 45.83 and 43.33% for the same concentration mentioned above. After 5 days the mortality percentage was 30.94, 48.84 and 48.81% for the same concentration mentioned above. After 6 days the mortality percentage was 34.01, 51.30 and 53.31% for the same concentration. Whereas after 7 days the mortality percentage

was 36.70, 53.38 and 57.08% .While after 8 days the mortality percentage was 39.08, 55.17 and 60.30 %. But after 9 days the mortality percentage increased to be 41.21, 56.75 and 63.08% for the same concentration. So concentration 80 give high mortality percentage to newly hatched larvae of *P. gossypiella* followed by concentration 60 then concentration 40 respectively.

Table(5):Cummulative mortality percentage of *P.gossypiella* newly hatched larvae after feeding on artificial diet immersed in different concentrations of *B. brongniartii* supernatant.

Protein conc. (%)	% of cummulative mortality during 2-9 days after treatment with supernatant							
	2	3	4	5	6	7	8	9
40	17.70	23.06	27.36	30.94	34.01	36.70	39.08	41.21
60	36.71	41.99	45.83	48.84	51.30	53.38	55.17	56.75
80	27.53	36.47	43.33	48.81	53.31	57.08	60.30	63.08

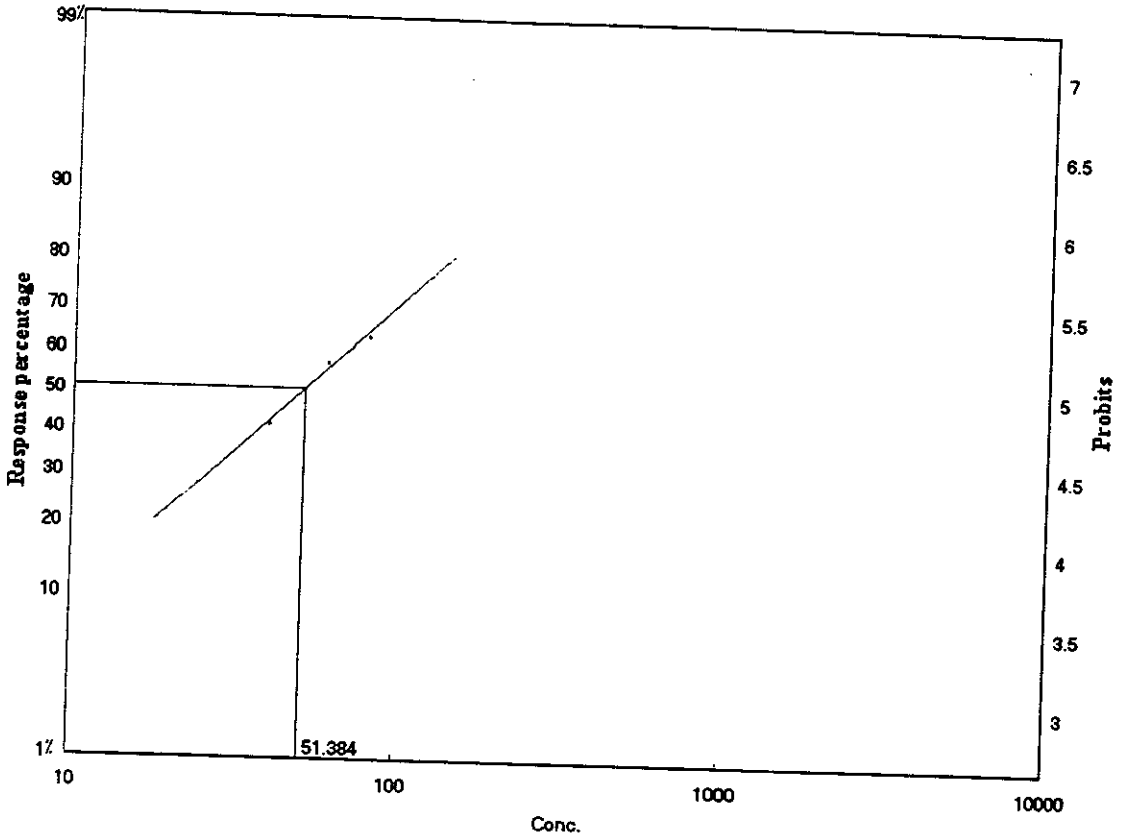

Fig. (5): Toxicity regression line of *B.brongniartii* against newly hatched larvae of *P. gossypiella* after nine days of treatment

Generally *M. anisopliae* was found to be the most effective isolate against newly hatched larvae of *P. gossypiella* followed by *B.bassiana, P. farinosus, M. flavovridae* then *B. brongniartii* respectively.

Probit analysis showed that Lethal time required for killing 50% of the larvae (LT_{50}) values for *M. anisopliae* (Table: 6 and Fig: 6) were 5.4324, 4.9369 and 3.1057 days for concentration 40, 60 and 80 %.

Table (6): Virulence of *M.anisopliae* against the newly hatched larvae of *P.gossypiella* expressed as Lethal time (LT_{50}) values

Protein conc. (%)	LT_{50} (days)	95% (Fiducial limit)		a Intercept	b Slope
		Lower	Upper		
40	5.4324	4.3488	7.0386	3.6989±0.3006	1.7702±0.4101
60	4.9369	4.1824	5.7865	3.2588±0.3150	2.5109±0.4300
80	3.1057	2.2898	3.7444	3.8505±0.2963	2.3355±0.4223

LT_{50}= Lethal time required for killing 50% of the larvae

While *M. flavovridae* data in (Table: 7 and Fig: 6) show that LT_{50} values were 6.5046, 6.2848 and 6.1880 days for concentrations 40, 60 and 80 respectively.

Table (7): Virulence of *M.flavovridae* against the newly hatched larvae of *P.gossypiella* expressed as Lethal time (LT_{50}) values.

Protein conc. (%)	LT_{50} days	95% (Fiducial limit)		a Intercept	b Slope
		Lower	Upper		
40	6.5046	5.4691	8.3372	3.1976±0.3258	2.2164±0.4367
60	6.2848	5.5273	7.3614	2.53398±0.3661	3.0818±0.4828
80	6.1880	5.4557	7.2007	2.5104±0.3672	3.1452±0.4845

LT_{50}= Lethal time required for killing 50% of the larvae

Whereas for *P.farinosus* (Table: 8 and Fig: 6) LT_{50} values ranged between 6.4807, 5.5482 and 4.1494 days for concentrations 40, 60 and concentration 80 of *P. farinosus*.

Table (8): Virulence of *P. farinosus* against the newly hatched larvae of *P.gossypiella* expressed as Lethal time (LT_{50}) values.

Protein conc. (%)	LT_{50} days	95% (Fiducial limit)		a Intercept	b Slope
		Lower	Upper		
40	6.4807	5.6685	7.7013	2.5971±0.3640	2.9606±0.4795
60	5.5482	4.6966	6.6999	3.2618±0.3178	2.3358±0.4301
80	4.1494	3.1045	5.1081	3.8791±0.2932	1.8138±0.4056

LT_{50}= Lethal time required for killing 50% of the larvae

As well as LT_{50} values for *B.bassiana* (Table: 9 and Fig: 6) ranged between 3-4 days for the concentrations 40, 60 and 80%.

Table (9): Virulence of *B.bassiana* against the newly hatched larvae of *P.gossypiella* expressed as Lethal time LT_{50} values.

Protein conc. (%)	LT_{50} days	95% (Fiducial limit)		a Intercept	b Slope
		Lower	Upper		
40	4.4183	3.3513	5.4899	3.8617±0.2939	1.7642±0.4052
60	4.0627	3.1510	4.8877	3.7502±0.2946	2.0529±0.4111
80	3.7828	2.7730	4.6251	3.9040±0.2926	1.8968±0.4071

LT_{50}= Lethal time required for killing 50% of the larvae

In addition to LT_{50} values for *B.brongniartii* as (Table: 10 and Fig: 6) was 14.4602, 5.4494 and 5.2473 days for concentration 40, 60 and 80%.

Table (10): Virulence of *B.brongniartii* against the newly hatched larvae of *P.gossypiella* expressed as Lethal time (LT_{50}) values.

Protein conc. (%)	LT_{50} days	95% (Fiducial limit)		a Intercept	b Slope
		Lower	Upper		
40	14.4602	8.5496	471.6990	3.7485±0.3137	1.0787±0.4228
60	5.4494	1.8614	2121.9638	4.4258±0.2841	0.7797±0.3906
80	5.2473	3.9093	7.3269	3.9740±0.2925	1.4251±0.4008

LT_{50}= Lethal time required for killing 50% of the larvae

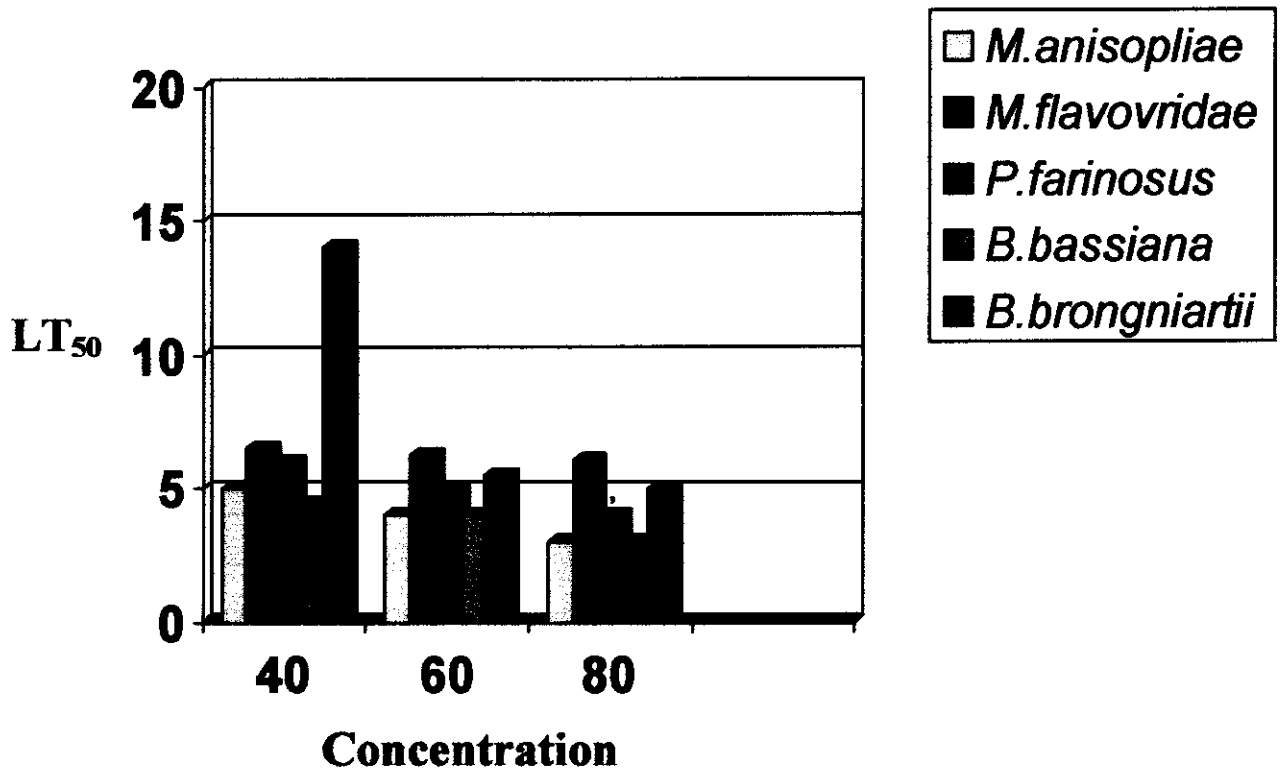

Fig.(6): Relationship between different concentrations of five isolates of newly hatched larvae of *P.gossypiella* and LT_{50}

Virulence of the tested entomopathogenic fungi (supernatant) against 1st instar larvae of *Spodoptera littoralis*:-

Data in table (11, 12, 13, 14, 15) show that the mortality percentage in the 1st instar larvae of *S.littoralis* increased with increasing the time elapsed after treatment.

For *M. anisopliae,* data in table (11) and fig (7) show that the mortality percentage after two days of treatment was 2.92,17.89 and 5.27% for the concentration 40,60 and concentration 80 respectively. After four days of treatment, the mortality

percentage was 9.30, 27.66 and 17.43% for the same concentration mentioned above. After six days of treatment, the mortality percentage was 16.14, 34.39 and 29.52% for the same concentration. After eight days of treatment, the mortality percentage was 22.61, 39.50 and 39.93% for the same concentration. While after ten days of treatment, the mortality percentage was 28.50, 43.60 and 48.58% for the same concentration. But after twelve days of treatment, the mortality percentage increased to be 33.80, 47.00 and 55.72% for the same concentration. So concentration 8o give high mortality percentage to first instar larvae of *S. littoralis* followed by concentration 60 then concentration 40 respectively.

Table (11):Cummulative mortality percentage of *S.littoralis* 1st instar larvae after feeding on artificial diet immersed in different concentrations of *M. anisopliae* supernatant.

Protein conc. (%)	% of cummulative mortality during 2-12 days after treatment with supernatant					
	2	4	6	8	10	12
40	2.92	9.30	16.14	22.61	28.50	33.80
60	17.89	27.66	34.39	39.50	43.60	47.00
80	5.27	17.43	29.52	39.93	48.58	55.72

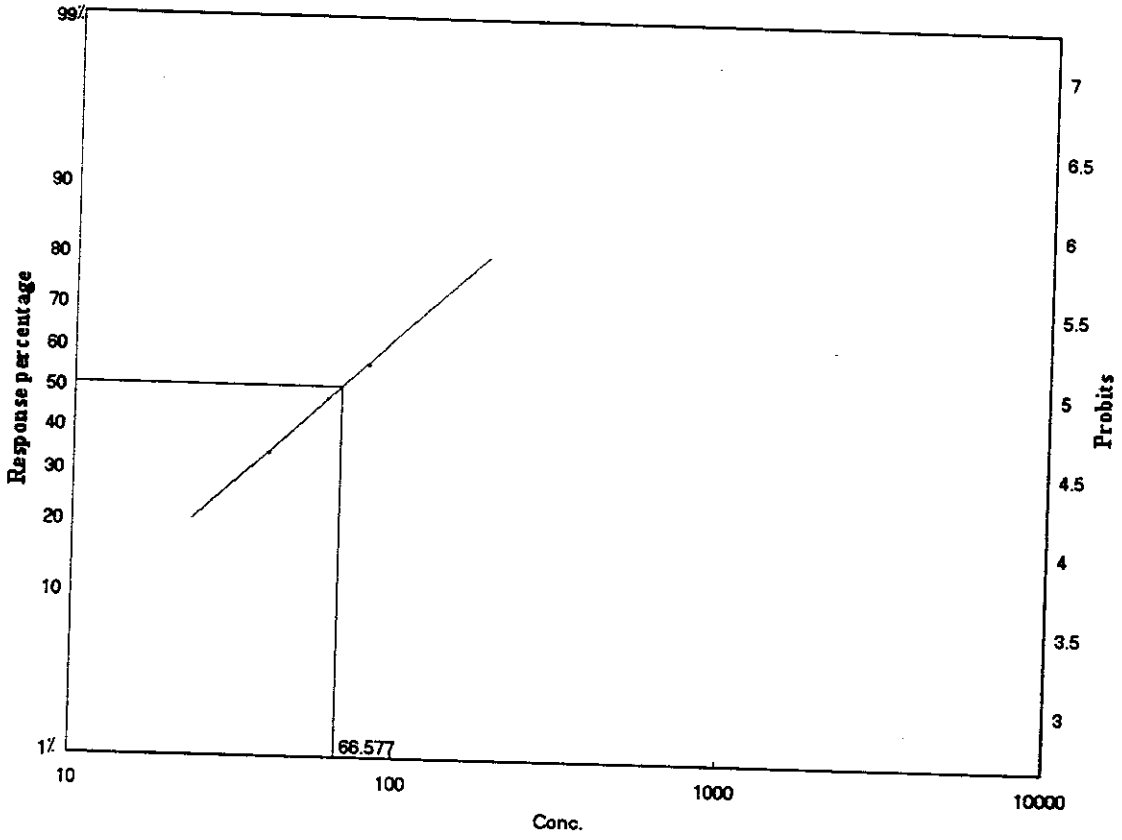

Fig. (7): Toxicity regression line of *M.anisopliae* against 1st instar larvae of *S.littoralis* after twelve days of treatment

Regarding *M.flavovridae*, data in table (12) and fig (8) show that the mortality percentage after two days was 15.68, 8.79 and 13.29% for the concentration 40, 60 and concentration 80 respectively. Through the period from the 4th to the 12th days, the mortality percentage increased with increasing the time elapsed post treatment. For example, mortality percentage was ranged between 23.46-28.62% after four days of treatment, while it ranged between 28.86 - 40.38% after six days, but after ten and twelve days the mortality percentage ranged between 36.38 - 56.39, 39.22 - 61.98 %.

Table (12):Cummulative mortality percentage of *S.littoralis* 1st instar larvae after feeding on artificial diet immersed in different concentrations of *M.flavovridae* supernatant.

Protein conc. (%)	% of cummulative mortality during 2-12 days after treatment with supernatant					
	2	4	6	8	10	12
40	15.68	23.46	28.86	33.01	36.38	39.22
60	8.79	17.82	25.16	31.20	36.28	40.61
80	13.29	28.62	40.38	49.37	56.39	61.98

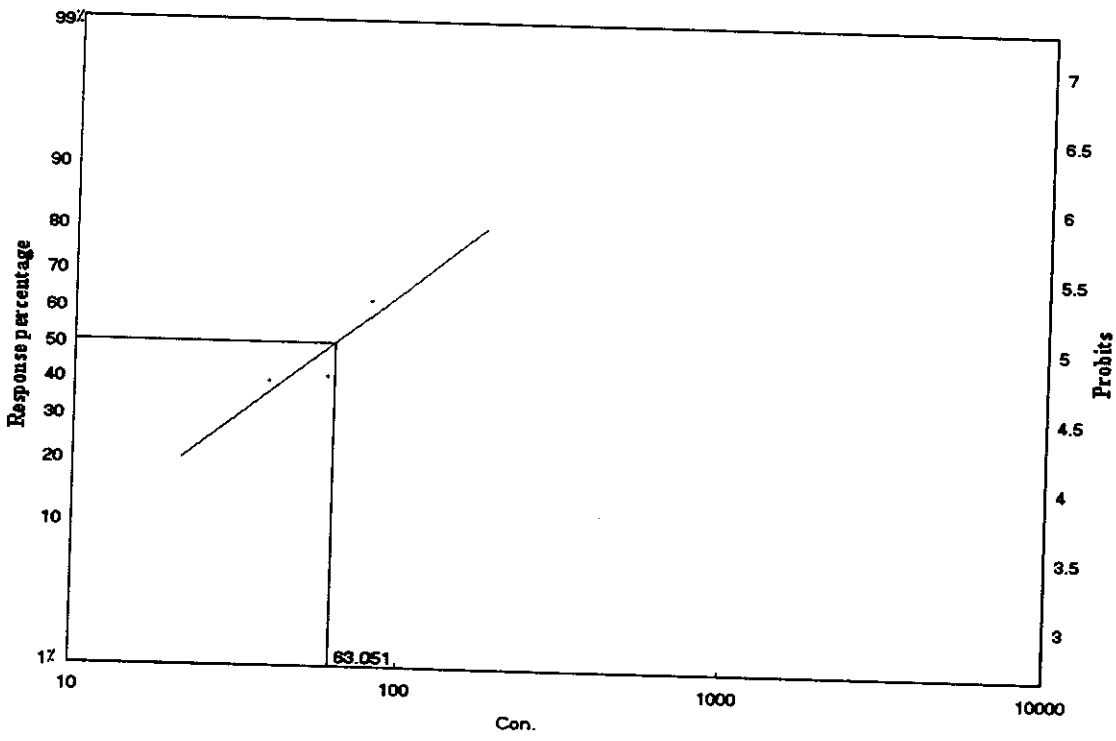

Fig.(8):Toxicity regression line of *M.flavovridae* against 1st instar larvae of *S.littoralis* after twelve days of treatment

Whereas the mortality percentage of *P. farinosus* (Table: 13 and Fig: 9) after two days was 1.65, 18.34 and 1.67% for concentration 40, 60 and concentration 80 respectively. After 4 days the mortality percentage was 3.59, 24.19 and 13.92% for the same concentration mentioned above. After 6 days the mortality percentage was 5.42, 28.04 and 31.77% for the same concentration.Whereas after 8 days the mortality percentage was 7.12, 30.93 and 48.34% for the same concentration. While after 10 days the mortality percentage was 8.70, 33.27 and 61.27% . But after 12 days the mortality percentage increased to be 10.17, 35.22 and 71.51% for the same concentration. So concentration 80 give high mortality percentage to first instar larvae of *S.littoralis* followed by concentration 60 then concentration 40 respectively.

Table (13):Cummulative mortality percentage of *S.littoralis* 1st instar larvae after feeding on artificial diet immersed in different concentrations of *P. farinosus* supernatant.

Protein conc. (%)	% of cummulative mortality during 2-12 days after treatment with supernatant					
	2	4	6	8	10	12
40	1.65	3.59	5.42	7.12	8.70	10.17
60	18.34	24.19	28.04	30.93	33.27	35.22
80	1.67	13.92	31.77	48.34	61.27	71.51

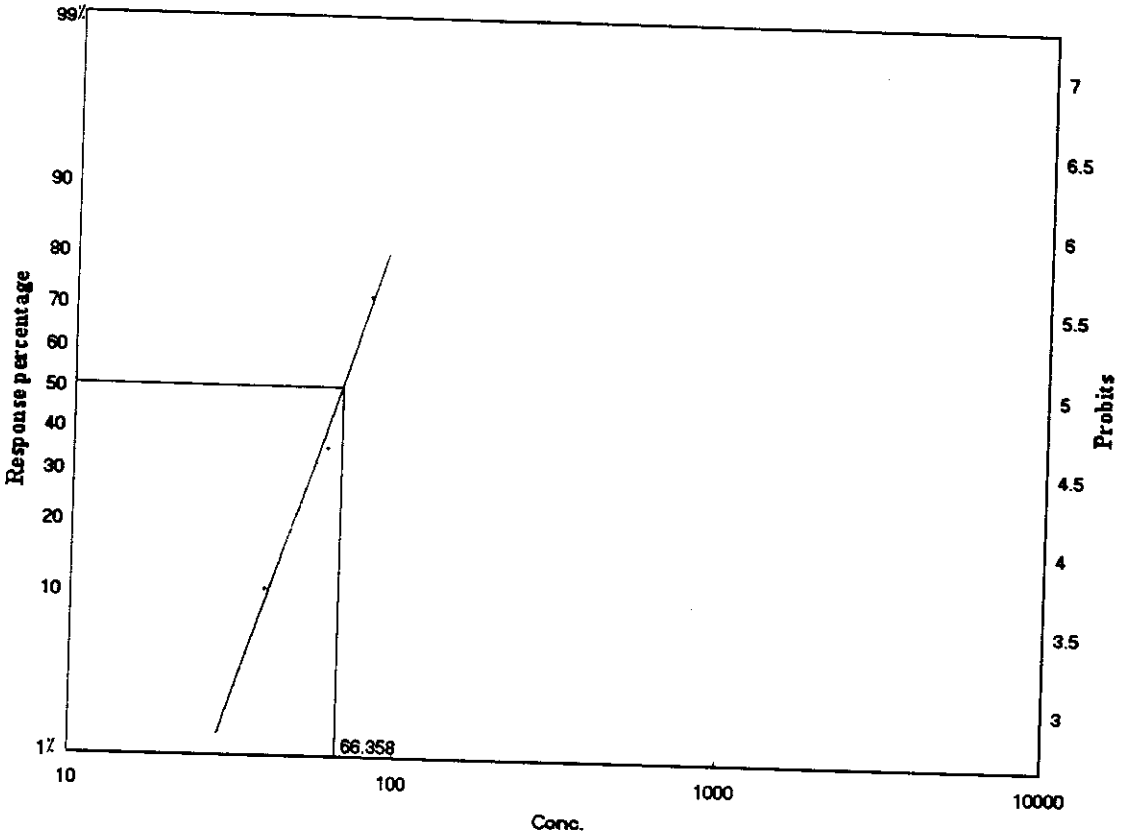

Fig.(9):Toxicity regression line of *P.farinosus* against 1st instar larvae of *S.littoralis* after twelve days of treatment

As well as *B. bassiana* (Table: 14 and Fig: 10) the mortality percentage increased with increasing the time elapsed after treatment at different concentrations. For example after two days of treatment was 0.00, 4.35 and 3.82% for the concentration 40, 60 and concentration 80 respectively, then gradual increase in mortality percentage appeared at different time intervals. Mortality percentage ranged between 14.99-31.23%.

Table (14):Cummulative mortality percentage of *S.littoralis* 1st instar larvae after feeding on artificial diet immersed in different concentrations of *B. bassiana* supernatant.

Protein conc. (%)	% of cummulative mortality during 2-12 days after treatment with supernatant					
	2	4	6	8	10	12
40	0.00	0.00	0.20	1.73	6.42	14.99
60	4.35	8.87	12.78	16.20	19.23	21.94
80	3.82	10.10	16.22	21.78	26.77	31.23

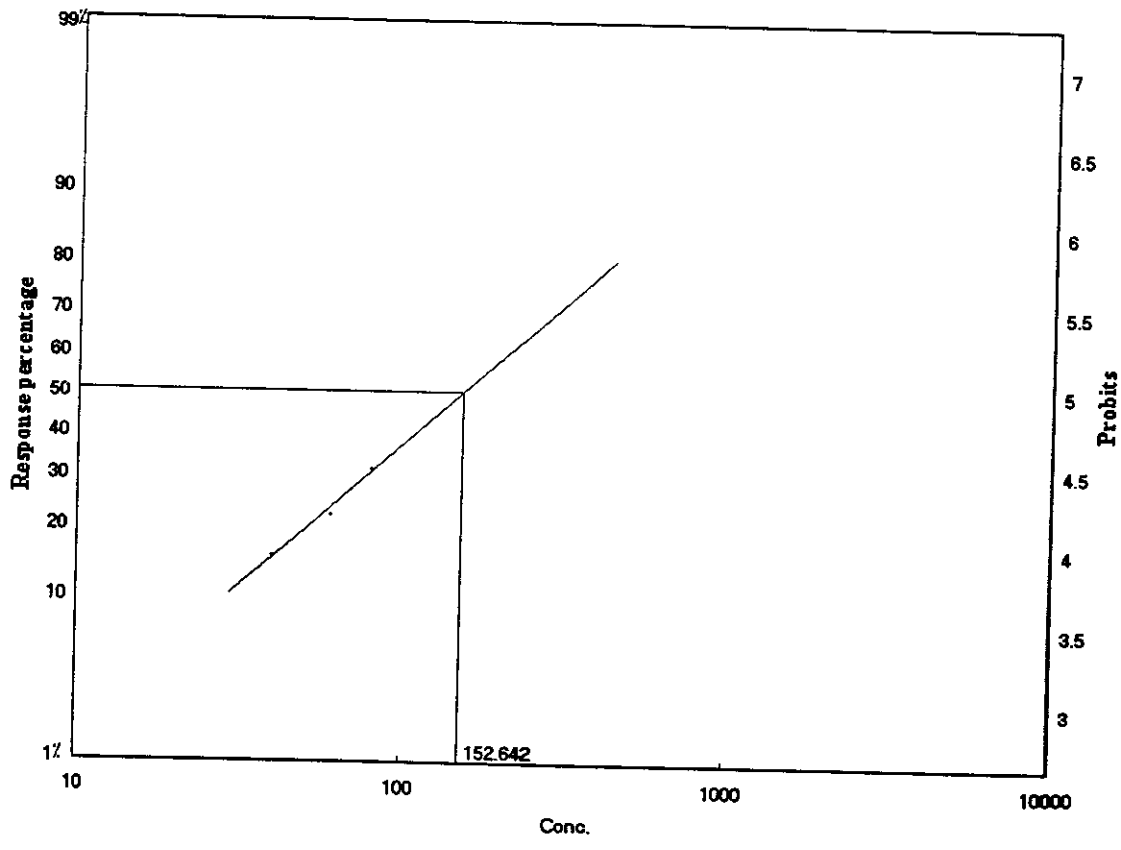

Fig. (10): Toxicity regression line of *B.bassiana* against 1st instar larvae of *S.littoralis* after twelve days of treatment

In addition to the mortality percentage of *B. brongniartii* (Table: 15 and Fig: 11) after two days was 12.71, 2.94 and 3.40% for the concentration 40, 60 and concentration 80 respectively. After four days the mortality percentage was 18.94, 13.27 and 22.84% for the same concentration mentioned above, while it ranged between 23.33 - 45.53%, 26.76 - 63.17%, 29.59 - 75.31% and 31.99-83.36% after 6, 8, 10 and 12 days.

Table (15):Cummulative mortality percentage of *S.littoralis* 1st instar larvae after feeding on artificial diet immersed in different concentrations of *B. brongniartii* supernatant.

Protein conc. (%)	% of cummulative mortality during 2-12 days after treatment with supernatant					
	2	4	6	8	10	12
40	12.71	18.94	23.33	26.76	29.59	31.99
60	2.94	13.27	25.46	36.67	46.47	54.59
80	3.40	22.84	45.53	63.17	75.31	83.36

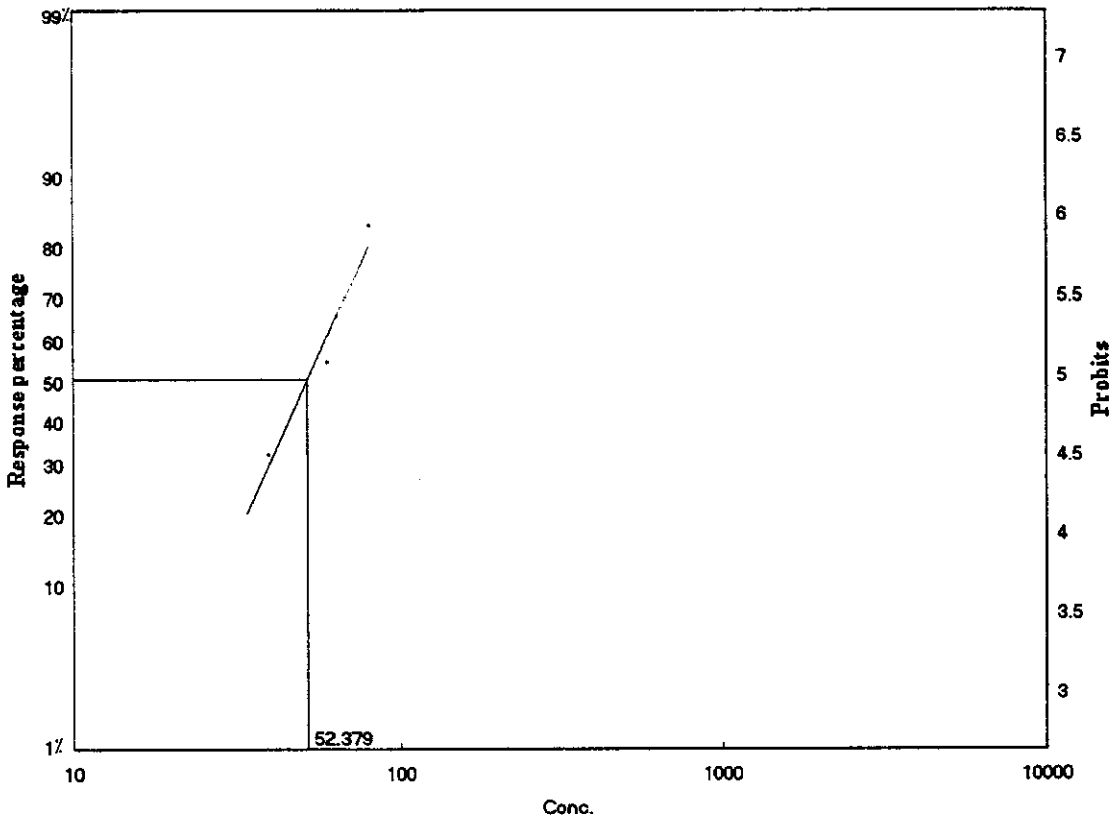

Fig.(11):Toxicity regression line of *B.brongniartii* against 1st instar larvae of *S.littoralis* after twelve days of treatment

Generally *B. brongniartii* was found to be the most effective isolate against first instar larvae of *S. littoralis* followed by *P.farinosus, M. flavovridae, M. anisopliae* then *B. bassiana.*

Probit analysis showed that LT_{50} for *M. anisopliae* as shown in table (16) and fig. (12) were 19.9311, 14.0767 and 10.3672 days for the concentrations 40,60 and concentration 80 respectively.

Table (16): Virulence of *M. anisopliae* against the1st instar larvae of *S.littoralis* expressed as Lethal time (LT_{50}) values.

Protein conc. (%)	LT_{50} days	95% (Fiducial limit)		a Intercept	b Slope
		Lower	Upper		
40	19.9311	13.1211	74.4226	2.5357±0.4834	1.8963±0.5406
60	14.0767	8.8280	107.2854	3.7539±0.3280	1.0850±0.3899
80	10.3672	8.3501	15.0212	2.6985±0.4121	2.2660±0.4710

$LT_{50=}$ Lethal time required for killing 50% of the larvae

While LT_{50} for as shown in (Table: 17 and Fig:12) for *M. flavovridae* was 23.3999, 17.5667 and 8.1619 days for 40,60 and concentration 80 respectively.

Table (17): Virulence of *M. flavovridae* against the1st instar larvae of *S.littoralis* expressed as Lethal time (LT_{50}) values.

Protein conc. (%)	LT_{50} days	95% (Fiducial limit)		a Intercept	b Slope
		Lower	Upper		
40	23.3999	11.7105	15391.5589	3.7084±0.3378	0.9433±0.4001
60	17.5667	11.2556	79.4659	3.2141±0.3777	1.4348±0.4379
80	8.1619	6.4031	11.6106	3.3385±0.3439	1.8223±0.4065

$LT_{50=}$ Lethal time required for killing 50% of the larvae

Whereas LT_{50} values for *P.ferscens* (Table: 18 and Fig: 12) were 169.4641, 43.9839 and 8.2238 days for concentration 40, 60 and concentration 80 respectively.

Table (18): Virulence of *P.farinosus* against the1st instar larvae of *S.littoralis* expressed as Lethal time (LT_{50})values.

Protein conc. (%)	LT_{50} days	95% (Fiducial limit)		a Intercept	b Slope
		Lower	Upper		
40	169.4641	0.00	0.00	2.5341±0.6191	1.1063±0.6936
60	43.9839	0.00	0.00	3.8950±0.3297	0.6725±0.3935
80	8.2238	7.1521	9.6897	1.8313±0.5025	3.4628±0.5653

$LT_{50=}$ Lethal time required for killing 50% of the larvae

Regarding *B. bassiana* as shown in table (19) and fig (12) LT_{50} values ranged between 52.7137, 23.7654 and 17.7365 days for concentration 40, 60 and concentration 80 respectively.