

General Introduction.

Table 1: Infectious diseases of the silkworm *Bombyx mori*, L.

Diseases	Causative agent	Symptoms
Virosis		
Nuclear polyhedrosis	<i>Bombyx mori</i> nuclear polyhedrosis virus (<i>BmNPV</i>)	Swollen intersegmental region; shining and fragile skin; milky white fluid.
Cytoplasmic polyhedrosis	<i>Bombyx mori</i> cytoplasmic polyhedrosis virus (<i>BmCPV</i>)	Translucent cephalothorax region; diarrhea; retarded growth; milky white midgut; whitish faeces.
Infectious flacherie	<i>Bombyx mori</i> infectious flacherie virus (<i>BmIFV</i>)	Translucent cephalothorax; retarded growth; vomiting and diarrhoea.
Densonucleosis	<i>Bombyx mori</i> densonucleosis virus (<i>BmDNV</i>)	Translucent cephalothorax; retarded growth; vomiting and diarrhoea.
Mycosis		
White muscardine	<i>Beauveria bassiana</i>	Oily specks on the body surface; larva on death softens, turns hard and latter mummifies; mummified larvae appear white.
Green muscardine	<i>Spicaria prasina</i> (<i>Nomuraea riyeli</i>), <i>Metarhizium anisopliae</i>	Large specks with black periphery; mummified larvae green in color
Yellow muscardine	<i>Pacilomyces farinosus</i>	Large disease specks around stigma and small on skin, mummified larvae yellow
Red muscardine	<i>Sporosporella urella</i>	Develop red colored patches few hours before death; no external growth
Bacterimia		
Bacterial disease of digestive organ	<i>Streptococci</i> sp. / <i>Staphylococci</i> sp	Sluggish movement; retarded growth; transparent cephalothoracic region
Septicemia	<i>Bacillus</i> sp., <i>Streptococci</i> sp. <i>Staphylococci</i> sp. <i>Serratia marcescens</i>	Sluggish movement; low appetite; swollen thorax; shrinkage; vomiting softened and discolored body
Toxicosis	<i>Bacillus thuringiensis</i> var. <i>Sotto</i>	Sluggish movement; retarded growth; caesation of feeding; vomiting; paralysis and death; corpse stretch and cephalothoracic region bend like hook.
Microsporidiosis		
	<i>Nosema bombycis</i>	Flaccid larvae; retarded growth; white pustules all along the length of the silk gland

Table 2: Non-infectious diseases of silkworm *Bombyx mori* L.

Diseases	Causative agent	Symptoms
Arthropod disease	<i>Exorista sorbillans</i> <i>Euproctis similis</i> <i>Setora postornata</i>	Black scar on the body
Poisoning	Poisonous chemicals	Vomiting gut juice; shrinkage
Physiological ailments	Poor nutrition, high temperature and humidity	Flaccidity

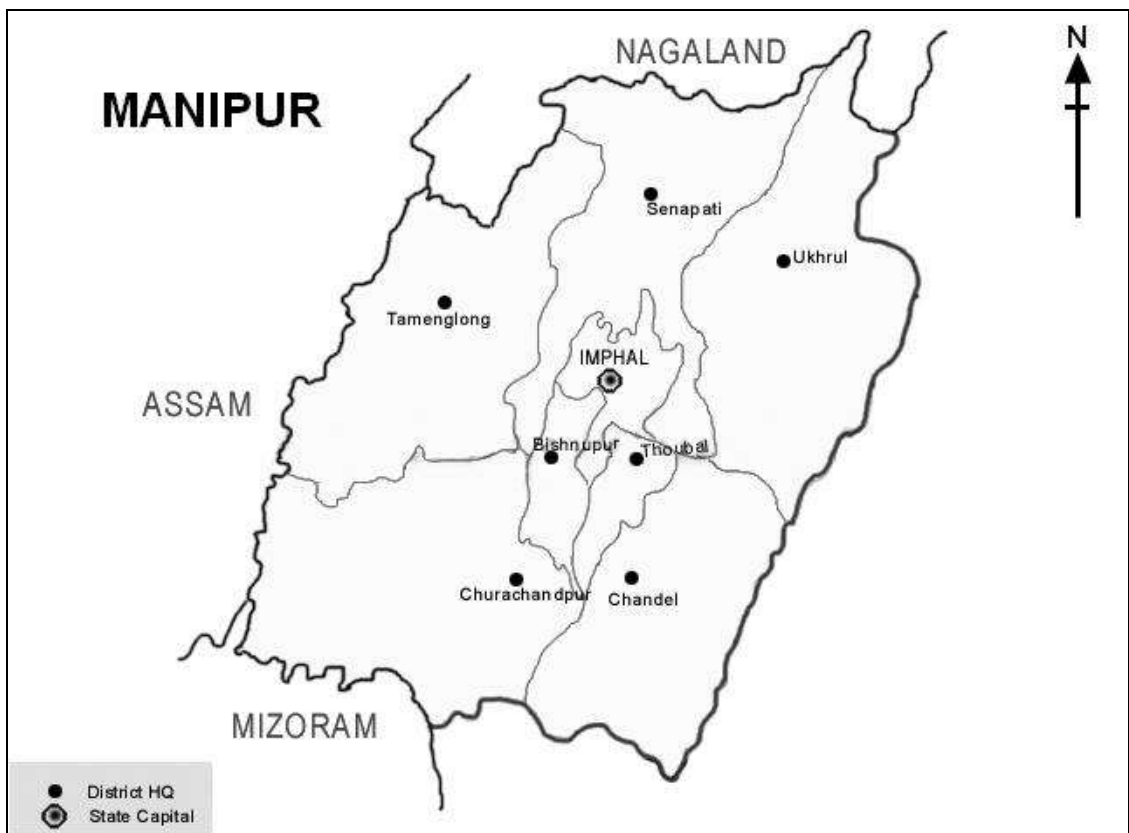


Fig. 1: The map showing the location of the State of Manipur, the native of Lamerin breed of the silkworm, *Bombyx mori*, L.

Chapter 1.

Table 1: Characteristic feature of microsporidians infecting silkworm, *Bombyx mori*, L.

Microsporidian isolates	Spore shape	Spore size (μm)		Virulence
		Length	Width	
<i>Nosema bombycis</i>	Oval	3.8	2.6	High
<i>Nosema</i> sp. (NIS-M11)	Oval	3.9	1.9	Low
<i>Nosema</i> sp. (NIS-M14)	Oval	4.1	2.3	High
<i>Nosema</i> sp. (NIK-2r)	Ovidal	3.6	2.8	High
<i>Nosema</i> sp. (NIK-3h)	Ovo cylindrical	3.8	1.8	Low
<i>Vairimorpha</i> sp. (NIS-M12)	Ovo cylindrical	4.5	2.0	Low
<i>Vairimorpha</i> sp. (NIK-4m)	Ovo cylindrical	5.0	2.1	High
<i>Microsporidium</i> sp. (NIS-25)	Oval	4.9	2.8	Low
<i>Pleistophora</i> sp.(NIS-M24)	Oval	2.7	1.6	Low
<i>Pleistophora</i> sp.(NIS-M27)	Ova	5.4	3.0	Low
<i>Thelohania</i> sp.(NIS-M32)	Oval	3.4	1.7	Low

Table 2: Characteristic features of the Lamerin breed of silkworm *Bombyx mori* L.

Metamorphic stage	Characteristic features
Egg	Light whitish yellow at the beginning and turns brownish on hibernation.
Larva	Plain, small, slender, creamy white. Length: 47.60±2.32 mm. Width: 4.82 ±0.30 mm. Weight: 2.59±0.1g. Larval period: 23 days.
Cocoon	Orange yellow coloured, small and open ended. Thick silk filament. Single cocoon weight: 1.47±0.02g. Single shell weight: 0.19±0.01g. Silk content is about 13.0±0.57%.
Pupa	Slender and brown in color. Pupation rate is 91.0±2.21%. Pupal period: 11.50±0.53 days.
Moth	Small and active. Fecundity: 301.7±22.26.

Table 3: Infectivity of Lamerin microsporidium isolate from Lamerin breed to different silkworm breeds.

Silkworm breeds	Mortality (%)		% Infectivity in moth stage	Total % infection and mortality	% infection in progeny	% Mortality in F1 progeny by microsporidiosis	
	Larva	Pupa				Larva	Pupa
Lamerin	5.8	5.20	54.29	65.29	59.20	12.40	6.00
PM	8.6	5.80	53.12	67.52	58.80	15.40	8.00
CSR2	11.2	8.80	56.95	76.95	57.20	17.00	9.40
CD@5%	5.02	2.21	2.73	3.03	2.90	3.07	0.86

Table 4: Morphological features of Lamerin microsporidium and *N.bombycis*.

Microsporidian isolates	Form	Spore size (μm)		Length/width ratio
		Length \pm S.D	Width \pm S.D	
Lamerin microsporidium	Ovo- cylindrical	4.36 ± 0.06	2.14 ± 0.01	2.03:1
<i>N.bombycis</i>	Oval	3.08 ± 0.21	2.01 ± 0.05	1.53:1

Table 5: Spore polar filament characteristics of Lamerin microsporidium and *Nosema bombycis*.

Microsporidian isolates	No. of coils of polar tube	Coil size (μm)		Coil length / width
		Length	Width	
Lamerin microsporidium	11	0.066	0.076	1:1.15
<i>N.bombycis</i>	12	0.078	0.073	1:0.93

Table 6: Serological affinity of Lamerin microsporidium and *N. bombycis*.

Microsporidian isolates	Serological reaction to the spores of			
	Monoclonal Antibodies of			Polyclonal Antibodies of
	<i>N.b.</i>	M11	M12	Lamerin microsporidian
Lamerin microsporidian	-	-	-	+
<i>N.bombycis</i>	+	-	-	-

+: Positive reaction; - : Negative reaction

Table 7: Artificial germination of Lamerin microsporidium and *N. bombycis*.

Microsporidian isolates	Conc. of KOH (%)	Time duration of the treatment (min)		
		10	20	30
Lamerin microsporidium	0.1	+	+	+
	0.3	+	+	+
	0.5	+	+	++
	0.7	++	++	+++
	0.9	++	++	+++
	1.00	++	++	++++
<i>N. bombycis</i>	0.1	+	++	++++
	0.3	+	++	++++
	0.5	+	+++	++++
	0.7	++	+++	++++
	0.9	++	+++	++++
	1.00	+++	++++	++++

Germination Index: +: 1- 40%; ++: 41 - 60%; +++: 61 - 80% and ++++: 81 - 100%

CHAPTER 2.

Table 1: Mode of infection of Lamerin microsporidia in Lamerin breed of the silkworm.

Treatment	%mortality &SD due to microsporidian infection		% Infected moths &SD	Fecundity &SD	% Eggs hatched & SD	% eggs unhatched &SD	% Infected eggs &SD	% Infected larvae &SD
	Larva	Pupa						
Leaf contamination (T1)	9.80±0.84	3.20±0.84	59.69±3.37	299.40±17.70	84.21±2.72	16.54±3.42	9.32±3.24	63.94±2.45
Body surface contamination (T2)	0.00±0.00	0.00±0.00	0.00±0.00	303.00±5.24	81.20±2.77	8.17±3.03	0.00±0.00	0.00±0.00
Egg surface contamination (T3)	11.80±0.84	5.20±0.84	62.29±5.40	308.40±9.15	84.51±4.76	9.60±1.49	10.82±4.23	58.13±5.34
Control (T4)	0.00±0.00	0.00±0.00	0.00±0.00	310.40±34.30	86.37±3.39	13.20±3.51	0.00±0.00	0.00±0.00
CD at 5%	0.82	0.87	4.83	--	--	4.37	3.11	4.19

Table 2: Infectivity of Lamerin microsporidia and *N. bombycis* spores to different silkworm breeds.

Silkworm Breed	Inoculum of microsporidian Isolate	% Mortality due to &SD		% Moths emerged &SD	% Moth infected &SD
		Larva	Pupa		
Lamerin	Lb _{ms} (T1)	0±0.00	0±00	100±0.00	41.40±5.59
	<i>N. bombycis</i> (T1a)	0±0.00	3.80±1.10	96.20±1.10	88.58±3.84
	Control (T1b)	0±0.00	0±0.00	100±0.00	0±0.00
CD@5%		-	0.92	0.92	6.70
PM	Lb _{ms} (T2)	0±0.00	0±00	100±0.00	41.20±3.49
	<i>N. bombycis</i> (T2a)	0±0.00	3.60±0.89	96.40±0.89	87.55±4.19
	Control (T2b)	0±0.00	0±0.00	100±0.00	0±00
CD@5%		-	0.75	0.75	5.56
CSR2	Lb _{ms} (T3)	0±0.00	0±00	100±0.00	48±1.58
	<i>N. bombycis</i> (T3a)	0±0.00	6.20±2.17	93.80±2.17	91.69±3.33
	Control (T3b)	0±0.00	0±0.00	100±0.00	0±00
CD@5%		-	1.83	1.83	2.52
Between the breeds	CD@5%	-	0.64	0.64	2.33
Between the treatments	CD@5%	-	0.64	0.64	2.33
Breed × Treatment	SE±	-	0.39	0.39	1.41
CD@5%		-	1.11	1.11	-

Lb_{ms}: Lamerin microsporidian; Value are mean ± S.D; Significant at 5% level; - No significant.

Table 3: Mode of transmission of Lamerin microsporidia and *N.bombycis* in different silkworm breeds.

Silkworm Breed	Microsporidian Isolate	Treatment	Eggs/ Laying	Hatching %	Transmission Percent	
Lamerin	Lb _{ms}	T11(HM× IF)	313±15.63	76.44±4.29	59.20±2.04	
		T12(IM× HF)	323±13.66	78.42±2.17	0.00±0.00	
		T13(IM×IF)	316±10.77	75.38±2.07	62.80±3.71	
	<i>N.bombycis</i>	T14(HM×IF)	280±6.31	63.74±2.75	100.00±0.00	
		T15(IM×HF)	319±17.30	72.37±2.84	0.00±0.00	
		T16(IM×IF)	268±12.62	64.56±1.57	100.00±0.00	
	Control	T17(HM×HF)	340±3.41	77.29±3.55	0.00±0.00	
CD at 5%			17.16	4.41	2.47	
P M	Lb _{ms}	T21(HM× IF)	409±12.21	93.14±1.68	58.80±0.98	
		T22(IM× HF)	405±24.49	92.82±2.08	0.00±0.00	
		T23(IM×IF)	402.6±6.22	95.84±1.46	64.00±6.07	
	<i>N.bombycis</i>	T24(HM×IF)	283±6.40	63.19±3.07	100.00±0.00	
		T25(IM×HF)	412±13.87	91.31±2.23	0.00±0.00	
		T26(IM×IF)	291±4.41	64.91±3.25	100.00±0.00	
	Control	T27(HM× HF)	413.6±16.52	92.88±1.91	0.00±0.00	
CD at 5%			19.27	3.44	3.34	
CSR2	Lb _{ms}	T31(HM× IF)	567.8±18.91	92.91±0.90	57.20±3.92	
		T32(IM× HF)	559±21.11	94.26±0.71	0.00±0.00	
		T33(IM×IF)	556.6±19.39	94.72±1.62	56.80±3.92	
	<i>N.bombycis</i>	T34(HM×IF)	283±5.64	53.68±6.19	100.00±0.00	
		T35(IM×HF)	525±21.81	93.66±2.91	0.00±0.00	
		T36(IM×IF)	289±5.38	58.72±2.98	100.00±0.00	
	Control	T37(HM×HF)	561.2±20.10	94.77±0.55	0.00±0.00	
CD at 5%			23.63	4.32	3.20	
Between the breeds		CD at 5%	7.77	1.45	1.08	
Between the treatments		CD at 5%	11.87	2.21	1.65	
Breed × Treatment		SE ±	7.31	1.36	1.01	
			CD at 5%	20.56	3.83	2.85

Lb_{ms}: Lamerin microsporidian; Values are mean±SD;

Table 4: Rate of spread of Lamerin microsporidian and *N. bombycis* in different breeds of the silkworms.

Silkworm Breed	Microsporidian isolate	No. of carriers introduced	Spread of infection			
			Dead larvae (%)	Dead pupae (%)	Infected moths (%)	Total spread (%)
Lamerin	Lb _{ms}	1 (T1)	0.00	0.00	1.06	1.06
		3 (T2)	0.00	0.00	2.81	2.81
		6 (T3)	0.00	0.00	6.60	6.60
		9 (T4)	0.00	0.00	9.64	9.64
	CD at 5%		-	-	0.34*	0.34*
	<i>N. bombycis</i>	1 (T13)	1.00	0.00	20.69	22.49
		3 (T14)	2.80	0.20	23.68	26.68
		6 (T15)	5.60	0.40	28.56	34.96
		9 (T16)	9.00	0.00	33.26	42.26
	Control	0 (T25)	0.00	0.00	0.00	0.00
	CD at 5%		0.45*	-	1.50*	1.63*
	Between A × B SE±		0.10*	0.10*	0.41*	0.49*
CD at 5%		0.29*	-	1.16*	1.41*	
PM	Lb _{ms}	1 (T5)	0.00	0.00	1.07	1.07
		3 (T6)	0.00	0.00	3.26	3.26
		6 (T7)	0.00	0.00	6.83	6.83
		9 (T8)	0.00	0.00	10.39	10.39
	CD at 5%		-	-	0.18*	0.18*
	<i>N. bombycis</i>	1 (T17)	0.60	0.40	22.10	23.30
		3 (T18)	2.20	0.20	23.15	26.15
		6 (T19)	5.80	0.20	30.37	36.37
		9 (T20)	8.80	0.20	31.55	41.54
	Control	0 (T26)	0.00	0.00	0.00	0.00
	CD at 5%		-	0.80*	-	2.03*
	Between A × B SE±			0.13*	0.43*	0.42*
CD at 5%		-	-	1.24*	1.20*	
CSR2	Lb _{ms}	1 (T9)	0.00	0.00	1.08	1.08
		3 (T10)	0.00	0.00	3.29	3.29
		6 (T11)	0.00	0.40	6.16	6.16
		9 (T12)	0.00	1.60	8.74	10.34
	CD at 5%		-	0.42	0.49	0.50
	<i>N. bombycis</i>	1 (T21)	1.00	0.60	43.15	44.75
		3 (T22)	3.00	0.60	46.90	50.50
		6 (T23)	6.00	1.20	53.46	60.66
		9 (T24)	9.00	1.00	66.41	76.36
	Control	0 (T27)	0.00	0.00	0.00	0.00
	CD at 5%		2.03*	0.45*	1.72*	1.73*
	Between A × B SE±		0.57*	0.17*	0.55*	0.62*
CD at 5%		1.64*	0.48*	1.43*	1.79*	

Lb_{ms}: Lamerin microsporidian; *Significant at 5%; -: Non significant

Table 5: Intensity and site of infection of silkworm by Lamerin microsporidia and *N. bombycis*.

Tissues	Lamerin microsporidia					<i>N. bombycis</i>				
	Days of PI and infection intensity					Days of PI and infection intensity				
	9	10	11	12	13	6	7	8	9	10
Gut	+	+	+	+	+	+	+	++	++	++
Malpighian tubules	-	-	+	+	+	+	+	++	++	++
Trachea	-	-	-	-	+	-	+	+	++	++
Silk gland	-	-	-	-	+	-	+	+	++	++
Fat bodies	-	+	+	+	+	+	+	++	++	++
Gonads	-	-	-	+	+	-	+	+	++	++
Haemolymph	-	-	-	-	+	-	-	-	+	+

-: No infection; ; +: Low infection; ++: High infection; PI : post inoculation

Table 6: Measurement of developmental stages of Lamerin microsporidia.

Stage	Size (μm)		Length/Width ratio
	Length &SD	Width &SD	
Meront	0.46 \pm 0.25	0.32 \pm 0.05	1:0.69
Sporont	1.11 \pm 0.05	0.78 \pm 0.10	1:0.70
Mature spore	4.36 \pm 0.06	2.14 \pm 0.01	1:0.49

Values are mean SD \pm .

Table 7: Comparative virulence of Lamerin microsporidia and *N. bombycis* to different silkworm breeds.

Microsporidian isolate	Doses Spores/ml	Silkworm Breeds											
		Lamerin				Pure Mysore				CSR2			
		% larva dead	% Pupa dead	% Moth dead	Total % infection	% larva dead	% Pupa dead	% Moth dead	Total % infection	% larva dead	% Pupa dead	% Moth dead	Total % infection
<i>Lb_{ms}</i> (A)	1 × 10 ³	0.00	0.00	38.40	38.40	0.00	0.00	34.40	34.40	0.00	0.00	44.20	44.20
	1 × 10 ⁴	0.00	0.00	41.80	41.80	0.00	0.00	37.80	37.80	0.00	0.00	45.80	45.80
	1 × 10 ⁵	0.00	0.00	45.80	45.80	0.00	0.00	42.80	42.80	0.00	0.00	47.00	47.00
	1 × 10 ⁶	0.00	0.00	45.40	45.40	0.00	3.40	47.60	51.80	2.40	2.40	46.80	51.60
	1 × 10 ⁷	5.40	2.60	49.40	57.00	8.20	5.60	49.20	61.80	10.40	8.40	46.20	64.80
	1 × 10 ⁸	8.60	2.80	51.40	62.20	10.00	5.60	49.60	65.20	12.40	7.40	50.20	70.80
	SE±	0.13	0.19	0.58	0.58	0.15	0.42	0.74	0.90	0.29	0.18	0.56	0.69
	CD@5%	0.39	0.55	1.72	1.70	0.45	1.24	2.19	2.60	0.86	0.52	1.64	2.03
<i>N. bombycis</i> (B)	1 × 10 ³	5.80	3.40	90.80	100	4.00	2.80	93.20	100	3.20	9.40	87.40	100
	1 × 10 ⁴	8.60	7.60	83.80	100	8.60	7.60	83.80	100	6.00	11.60	82.40	100
	1 × 10 ⁵	12.40	7.80	79.80	100	8.40	8.60	83.20	100	10.60	15.30	74.20	100
	1 × 10 ⁶	21.20	15.40	63.40	100	23.60	15.40	61.00	100	28.80	27.80	44.00	100
	1 × 10 ⁷	29.20	22.60	50.20	100	30.00	25.00	45.00	100	38.60	35.20	25.0	100
	1 × 10 ⁸	61.20	30.20	8.60	100	76.80	20.40	2.80	100	86.40	13.60	-	-
	SE±	1.00	0.79	1.44	-	0.99	1.17	1.65	-	1.07	1.19	1.28	-
	CD@5%	2.93	2.32	2.26	-	2.33	3.46	4.86	-	3.16	3.50	3.78	-
Between (A × B)	SE±	0.57	0.49	0.95	0.44	0.54	0.71	1.01	6.11	0.64	0.72	0.83	0.47
	CD@ 5%	1.62	1.39	2.68	1.24	1.51	2.00	2.86	17.28	1.87	2.04	2.34	1.34

Lb_{ms}: Lamerin microsporidian; -: Non significant

Table 8: LC₅₀ and fiducial limits of Lamerin microsporidia and *N. bombycis* to different silkworm breeds

Silkworm Breeds	Microsporidian isolate	X – mean	Y-Mean	Probit Equation	Chi-Square	SE - b	Probability	Fiducial Limit	LC ₅₀ value
Lamerin	Lb _{ms}	7.789	3.180	Y= -3.44+0.85 X	6.65 NS	0.281	0.913	11.990 - 7.889	8.7×10 ⁹
Lamerin	<i>N. bombycis</i>	5.814	4.781	Y=1.99+0.48 X	2.60 NS	0.091	0.264	6.471 - 5.998	1.7×10 ⁶
P. M	Lb _{ms}	7.660	3.953	Y=-3.63+0.99 X	3.04 NS	0.223	0.751	9.145 - 8.191	4.7×10 ⁸
P. M	<i>N. bombycis</i>	5.798	4.898	Y=1.42+0.60 X	3.98 NS	0.123	0.217	6.161 - 5.761	9.1×10 ⁵
CSR2	Lb _{ms}	7.584	4.097	Y=-3.79+1.04 X	4.82 NS	0.235	0.712	8.773 - 8.120	2.8×10 ⁸
CSR2	<i>N. bombycis</i>	5.261	5.026	Y=0.87+0.79 X	9.50 NS	0.193	0.119	5.724 - 4.699	1.6×10 ⁵

Lb_{ms}: Lamerin microsporidian

Table 9: Susceptibility of different silkworm breeds to the Lamerin microsporidia and *N. bombycis*.

Microsporidian isolates	Silkworm breed	% Mortality &SD	No. moth Emerged &SD	% moths infected &SD
Lb _{ms} (A)	CSR2	20.0±1.0	80.4±0.5	57.0±2.9
	CSR18	18.6±1.5	82.6±2.2	55.9±3.1
	CSR19	19.4±2.6	80.2±2.7	50.9±2.7
	NB4D2	15.6±0.5	84.4±0.5	48.8±1.6
	Lamerin	10.2±1.6	89.8±1.6	54.3±1.2
	Pure Mysore	12.6±1.5	86.2±0.8	53.1±1.4
	Nistari	13.0±1.2	86.2±2.9	46.7±1.2
CD at 5%		2.0	2.4	2.9
<i>Nosema bombycis</i> (B)	CSR2	75.0±3.0	25.0±3.0	100.0±0.0
	CSR18	73.8±1.1	28.2±0.8	100.0±0.0
	CSR19	74.6±5.5	25.0±5.2	100.0±0.0
	NB4D2	71.4±3.8	28.6±3.8	100.0±0.0
	Lamerin	47.6±3.0	52.4±3.0	100.0±0.0
	Pure Mysore	53.2±3.1	46.8±3.1	100.0±0.0
	Nistari	63.6±2.9	36.4±2.9	100.0±0.0
CD at 5%		4.52	4.43	--
Treatment (A)	CD at 5%	1.28	1.30	0.74
Treatment (B)	CD at 5%	2.39	2.44	1.38
Between treatments (A × B) SE±		1.19	1.22	0.69
CD at 5%		3.38	3.44	1.94

Lb_{ms}-Lamerin microsporidian; - Non significant; Values are mean ± SD

CHAPTER 3.

Table 1: Impact of Lamerin microsporidian infection on the economic characters of different bivoltine and multivoltine silkworm breed.

Silkworm Breed	Treatment	% Mortality		Larval wt. (g)	Larval duration (D:H)	% ERR	Single cocoon wt. (g)	Single shell wt. (g)	SR%	% of moths infected
		Larva	pupa							
CSR2	Lb _{ms}	11.2	8.8	32.8	24.00	80.40	1.632	0.374	22.91	45.80
	<i>N.bombycis</i>	38.2	36.8	29.6	25.00	25.60	1.314	0.282	21.46	100.00
	Control	0.00	0.00	33.4	24.00	95.80	1.666	0.390	23.41	0.00
	SE±	0.5	0.5	0.2	0.5	0.88	0.007	0.004	0.18	1.2
	CD@5%	1.5	1.7	0.5	-	2.87	0.021	0.012	0.60	3.8
CSR18	Lb _{ms}	8.8	8.3	32.4	24.00	82.60	1.594	0.368	23.05	47.00
	<i>N.bombycis</i>	35.80	39.00	29.0	25.00	21.80	1.298	0.290	22.34	100.00
	Control	0.00	0.00	33.5	24.00	95.00	1.638	0.390	23.81	0.00
	SE±	0.2	0.4	0.3	0.5	1.42	0.004	0.008	0.57	1.1
	CD@5%	0.7	1.3	0.0	-	4.64	0.013	0.027	-	3.4
CSR19	Lb _{ms}	9.5	11.00	32.6	24.00	82.20	1.588	0.374	23.34	41.00
	<i>N.bombycis</i>	41.4	34.60	29.9	25.00	24.40	1.368	0.292	21.35	100.00
	Control	0.00	0.00	33.7	24.00	94.20	1.630	0.384	23.54	0.00
	SE±	1.0	1.2	0.2	0.5	1.73	0.008	0.007	0.57	1.5
	CD@5%	3.3	3.9	0.6	-	5.63	0.025	0.023	1.86	4.8
NB4D2	Lb _{ms}	9.3	6.5	32.6	24.00	84.40	1.666	0.364	21.80	40.8
	<i>N.bombycis</i>	36.4	36.6	29.8	25.00	27.40	1.416	0.274	19.35	100.00
	Control	0.00	0.00	34.4	24.00	95.40	1.648	0.376	22.81	0.00

	SE±	0.7	0.7	0.3	0.5	1.03	0.011	0.009	0.52	1.0
	CD@5%	2.3	2.4	1.0	-	3.34	0.036	0.031	1.89	3.1

Cont...

Silkworm Breed	Treatment	% Mortality		Larval wt. (g)	Larval duration (D:H)	% ERR	Single cocoon wt. (g)	Single shell wt. (g)	SR%	% of moths infected
		Larva	pupa							
Lamerin	Lb _{ms}	5.5	4.0	25.4	24.00	89.20	1.046	0.132	12.45	49.5
	<i>N.bombycis</i>	27.2	20.6	23.9	25.00	55.60	0.996	0.114	11.44	100.00
	Control	0.00	0.00	25.8	24.00	96.20	1.482	0.196	13.28	0.00
	SE±	0.7	0.1	0.3	0.5	2.11	0.043	0.008	0.32	1.6
	CD@5%	2.4	0.5	1.0	-	6.88	0.141	0.025	1.04	5.2
PM	Lb _{ms}	9.3	4.5	22.4	26.00	85.80	1.016	0.124	12.02	46.5
	<i>N.bombycis</i>	31.6	25.6	21.6	27.00	42.80	0.868	0.104	11.98	100.00
	Control	0.00	0.00	22.9	26.00	96.20	1.036	0.134	12.94	0.00
	SE±	1.0	1.0	0.3	0.8	1.93	0.007	0.003	0.26	1.9
	CD@5%	3.4	3.1	0.09	-	6.29	0.023	0.009	-	6.2
Nistari	Lb _{ms}	8.3	5.8	21.3	26.00	85.00	0.888	0.140	13.28	40.0
	<i>N.bombycis</i>	36.6	27.8	20.1	27.00	36.40	0.786	0.100	12.74	100.00
	Control	0.00	0.00	23.4	26.00	96.20	0.912	0.144	15.79	0.00
	SE±	0.5	0.8	0.2	0.8	1.20	0.010	0.001	0.39	0.8
	CD@5%	1.8	2.6	0.7	-	3.94	0.034	0.005	0.04	2.7

Lb_{ms}: Lamerin microsporidian; -: Non-significant

Table 2: Viability response of Lamerin microsporidian spore to UV-rays.

Treatment	Treatment duration (Sec.)	Sporicidal activity	
		% spore killed	% larvae infected
UV Rays	30	0.00	10.00
	60	18.43	8.8
	300	52.00	7.4
	600	77.33	1.6
	900	94.27	0.4
	1200	100.00	0.00
	Control	0.00	10.6
CD@5%	-	5.8	0.9

Inoculum: 1×10^7 Spores / ml

Table 3: Viability response of Lamerin microsporidian spore to sunlight.

Treatment	Treatment duration (Sec.)	Sporicidal activity	
		% spore killed	% larvae infected
Sunlight	30	2.00	10.40
	60	6.30	9.80
	120	12.20	9.60
	180	15.00	8.40
	Control	0.00	10.60
CD@5%	-	4.6	0.9

Inoculum: 1×10^7 Spores / ml

Table 4: Viability response of Lamerin microsporidian spore to hot water.

Treatment	Temperature (°C)	% of spores killed in different treatment durations (min)		
		1	3	5
Hot water	30	0.00	0.00	0.00
	40	0.00	0.00	0.00
	50	2.90	7.10	12.10
	60	4.90	13.00	38.40
	70	19.20	41.80	63.70
	80	41.00	92.00	100.00
	90	49.10	92.20	100.00
	100	67.10	100.00	100.00
Control	-	0.00		
CD@5%		3.10	3.10	3.10

Table 5: Percent mortality in silkworm *per os* inoculated with microsporidian spores treated with hot water.

Treatment	Temperature (°C)	% Larval mortality in different treatments duration of treatment (min)		
		1	3	5
Hot water	50	9.67	7.67	7.33
	60	9.67	7.33	6.33
	70	9.00	5.67	4.33
	80	3.67	1.33	0.00
	90	2.33	0.00	0.00
	100	1.67	0.00	0.00
Control	10.67			
CD@5%		1.57	1.11	1.26

Table 6: Viability response of Lamerin microsporidian spore to hot air.

Treatment	Temperature(°C)	% of spores killed in different durations (min)				
		1	5	30	60	120
Hot air	30	0.00	0.00	0.00	0.00	0.00
	40	0.00	0.00	0.00	2.60	7.40
	50	0.00	0.00	0.00	7.40	12.20
	60	0.00	4.50	9.20	24.2	36.00
	70	0.00	13.10	23.00	30.00	41.50
	80	0.80	41.30	74.10	63.00	83.80
	90	1.80	41.90	49.00	92.00	100.0
	100	2.20	43.80	63.50	99.00	100.0
Control		0.00				
CD@5%		1.7	4.6	0.2	6.0	5.1

Table 7: Percent mortality in silkworm *per os* inoculated with microsporidian spores treated with hot air.

Treat- ment	Tempe- rature(°C)	% larval mortality in different treatment durations (min)				
		1	5	30	60	120
Hot air	40	9.67	9.67	9.67	9.33	9.33
	50	9.67	9.33	9.33	9.00	8.67
	60	9.67	9.33	9.00	8.67	8.00
	70	9.67	9.00	8.33	8.00	7.67
	80	9.67	8.67	7.33	4.33	1.33
	90	9.00	3.33	2.67	1.00	0.00
	100	4.33	1.00	0.67	0.00	0.00
	Control	10.67				
	CD@5%	1.00	1.40	0.89	0.98	0.78

Table 8: Viability response of Lamerin microsporidian spore to different chemical disinfectants.

Treatments	Concentration (%/ppm)	Sporocidal activity in different treatments durations (min)			
		5	10	20	30
Chlorine dioxide	50ppm	+	+	+	+
	100	+	+	+	+
	200	+	+	+	+
	300	+	+	-	-
	400	-	-	-	-
	500	+	+	+	-
Bleaching powder	0.5%	+	+	+	+
	1%	+	-	-	-
	1.5%	-	-	-	-
	2%	-	-	-	-
Formalin	0.5%	+	+	+	+
	1%	-	-	-	-
	1.5%	-	-	-	-
	2%	-	-	-	-
Phenol	1%	+	+	+	+
	3%	+	+	+	+
	5%	+	+	+	+
	7%	+	+	+	-
	9%	+	-	-	-
Potassium permanganate	1%	+	+	+	+
	2%	+	+	+	+
	3%	+	+	+	+

+ In effective; - Effective

Table 9: Percent mortality after inoculation of Lamerin microsporidia spores (1×10^7) treated with different chemical disinfectants.

Treatment	Concentration (%/ppm)	% mortality in different treatment duration caused by treated spores (min)			
		5	10	20	30
Chlorine dioxide	50ppm	10.00	7.33	7.33	45.33
	100ppm	9.67	7.33	5.66	3.33
	200ppm	8.00	5.66	4.33	2.33
	300ppm	5.67	5.00	3.00	1.66
	400ppm	5.33	3.66	0.00	0.00
	500ppm	0.00	0.00	0.00	0.00
	Control	10.67			
CD@5%	1.29	1.70	2.65	2.43	
Bleaching powder	0.50%	10.67	4.67	3.00	2.33
	1.00%	3.33	0.67	0.00	0.00
	1.50%	0.67	0.00	0.00	0.00
	2.00%	0.00	0.00	0.00	0.00
	Control	10.67			
	CD@5%	0.88	2.60	1.65	1.48
Formalin	0.50%	9.67	4.33	3.33	1.67
	1.00%	2.67	0.33	0.00	0.00
	1.50%	0.00	0.00	0.00	0.00
	2.00%	0.00	0.00	0.00	0.00
	Control	10.67			
	CD@5%	0.84	2.81	1.48	0.73
Phenol	1.00%	9.00	9.00	8.67	8.66
	3.00%	8.67	8.33	7.33	6.00
	5.00%	8.33	7.33	6.33	3.33
	7.00%	5.66	5.33	0.33	0.33
	9.00%	3.33	1.00	0.00	0.00
	Control	10.67			
	CD at 5%	1.93	2.22	1.37	1.69
Potassium Permanganate	1.00%	10.00	7.00	4.67	3.67
	3.00%	5.33	3.00	2.67	2.00
	5.00%	3.00	2.67	2.33	1.67
	Control	10.67			
	CD at 5%	3.03	2.47	3.26	1.00

Table 10: Efficacy of different temperature treatments of eggs in control of microsporidian infection in Lamerin breed.

Treatment °C	Fecundity	% dead eggs	% hatching	% Mortality	% RMOIC	SCW (g)	SSW	SR	% infected moths
40/5min	398	9.2	90.7	2.3	74.3	0.88	0.10	11.4	17.0
40/10min	335	11.3	88.7	1.0	88.0	0.86	0.09	11.5	13.8
40/15min	370	14.0	85.7	1.7	80.9	0.88	0.09	11.2	15.3
45/5min	393	11.5	88.0	0.7	92.1	0.89	0.09	11.0	11.1
45/10min	397	8.8	90.7	0.7	92.1	0.90	0.10	11.2	12.1
45/15min	389	5.0	92.9	0.3	96.3	1.00	0.10	10.5	10.7
50/5min	335	5.3	84.2	0.0	100.0	1.12	0.13	11.7	10.0
50/10min	394	17.4	81.6	3.0	66.9	0.93	0.10	11.3	13.1
50/15min	414	23.5	76.4	2.0	77.1	0.89	0.10	11.3	12.6
Control	346	13.1	84.3	9.0	0.0	0.90	0.09	10.5	45.3
CD at 5%	-	-	-	1.3	12.9	0.5	0.06	-	2.3

RMOIC-Reduction in mortality over inoculated control; - Non significant

Table 11: Screening of different of benzimidazole and quine derivatives for antimicrosporidianaction against Lamerin microsporidia spores.

Sl.No.	Name of the drug	Chemical formula	Concentrations (%)	Effective
1	Metronidazole	$C_6H_9N_3O_3$	0.25	+
			0.50	+
			1.00	-
2	Albendazole	$C_{12}H_{15}N_3O_2S$	0.25	+
			0.50	+
			1.00	-
3	Tinidazole	$C_8H_{13}N_3O_4S$	0.25	+
			0.50	+
			1.00	+
4	Ornidazole	$C_7H_{10}C_1N_3O_3$	0.25	+
			0.50	+
			1.00	-
5	Mebendazole	$C_{16}H_{13}N_3O_3$	0.25	-
			0.50	-
			1.00	-
6	Satranidazole	$C_8H_{11}O_5N_5S$	0.25	+
			0.50	+
			1.00	+
7	Primaquine	$C_{15}H_{21}N_3O$	0.25	+
			0.50	+
			1.00	-
8	Sapraquine	NA	0.25	-
			0.50	-
			1.00	-
9	Chloroquine	$C_{18}H_{29}C_1N_3-H_3PO_4$	0.25	+
			0.50	+
			1.00	-
	Control		-	+

+ Ineffective; - Effective

Table 12: Efficacy of benzimidazole derivatives in disease control/suppression of Lamerin microsporidian in Lamerin breed.

Treatment	% mortality and disease reduction due to treatment of different concentrations				Treatment			
	0.25%	0.50%	1.00%	Control				
Metronidazole	1.33±0.57 (85.74) ^b	1.00±0.00(89.28) ^b	0.66±0.57(92.92) ^b	9.33±0.57	3.08±3.80			
Albendazole	1.33±0.57(85.74) ^b	0.33±0.57(96.46) ^b	0.00±0.57(100.0) ^b		2.75±4.02			
Tinidazole	1.66±0.57(82.20) ^b	1.66±1.15(82.20) ^b	1.00±1.00(89.28) ^b		3.41±3.65			
Ornidazole	2.00±1.00(78.56) ^b	1.33±0.57(85.74) ^b	0.33±0.57(96.46) ^b		3.25±3.76			
Mebendazole	0.00±1.00(100.00) ^b	0.00±0.57(100.0) ^b	0.00±0.57(100.0) ^b		2.33±4.22			
Satranidazole	1.66±0.57(82.20) ^b	2.00±1.00(78.56) ^b	0.66±0.57(92.92) ^b		3.41±3.65			
Concentrations	1.33±0.84	1.05±0.93	0.44±0.61					
Source of Variations	df	Sum of Squares	Mean Squares	F Ratio	Probability	η ²	ηp ²	ω ²
Treatment	5	10.958333	2.191667	5.64	0.0004***	0.011	0.37	0.009
Concentration	3	957.486111	319.162037	820.7	0.0000***	0.962	0.981	0.49
Treat × Conc.	15	7.763889	0.517593	1.33	0.2213	0.008	0.294	0.002
Error (B)	48	18.666667	0.388889					
Total	71	994.875	14.012324					
Comparison	Std. Error	S.E.Difference	t-value 5%	C. Difference				
Treatment	0.18002	0.25459	2.01063	0.51188				
Conc.	0.14699	0.20787	2.01063	0.41795				
Treat. × Conc.	0.36004	0.50918	2.01063	1.02376				

Significant at 5% level; ** Significant at 1% level; *** Significant at 0.1% level; (^b) % reduction in mortality in parantheses

Table 13: Efficacy of benzimidazole derivatives in disease control/suppression of Lamerin microsporidian in CSR2.

Treatment	% mortality and disease reduction due to treatment of different concentrations				Treatment			
	0.25%	0.50%	1.00%	Control				
Metronidazole	2.67±1.16 (80.46) ^b	2.00±0.00(85.36) ^b	1.67±0.58(87.78) ^b	13.67±1.16	5.00±5.29			
Albendazole	2.67±0.58(80.46) ^b	0.67±0.58(95.09) ^b	0.00±0.58(100.0) ^b		4.25±5.80			
Tinidazole	3.67±1.16(73.15) ^b	3.00±1.00(78.05) ^b	2.00±1.00(85.36) ^b		5.00±5.00			
Ornidazole	3.33±0.58(75.64) ^b	3.00±1.00(78.05) ^b	1.00±1.00(92.68) ^b		5.25±5.21			
Mebendazole	0.00±0.00(100.0) ^b	0.00±1.00(100.0) ^b	0.00±0.58(100.00) ^b		4.00±5.94			
Satranidazole	2.33±1.16(82.95) ^b	3.00±0.00(78.05) ^b	1.33±0.008(90.27) ^b		5.08±5.28			
Concentrations	2.44±1.42	1.94±1.35	1.39±0.98					
Source of Variations	df	Sum of Squares	Mean Squares	F Ratio	Probability	η^2	ηp^2	ω^2
Treatment	5	22.277778	4.455556	5.94	0.0002 ***	0.01	0.382	0.009
Concentration	3	1870.944444	623.648148	831.53	0.0000 ***	0.95	0.981	0.487
Treat. × Conc.	15	39.388889	2.625926	3.5	0.0005 ***	0.02	0.522	0.014
Error (B)	48	36	0.75					
Total	71	1968.611084	27.726917					
Comparison	Std. Error	S.E. Difference	t value 5%	C.Difference				
Treatment	0.25	0.35355	2.01063	0.71086				
Concentration	0.20412	0.28868	2.01063	0.58042				
Treat. × Conc.	0.5	0.70711	2.01063	1.42173				

Significant at 5% level; ** Significant at 1% level; *** Significant at 0.1% level; (^b) % reduction in mortality in parantheses

Table 14: Efficacy of different benzimidazole derivatives on suppression of infection in moth stage of Lamerin breed.

Treatment	% infection and reduction in infection due to treatment of different concentrations				Treatment			
	0.25%	0.50%	1.00%	Control				
Metronidazole	25.18±2.88(59.59) ^b	24.56±0.66(58.63) ^b	23.40±1.54(60.59) ^b	59.38±4.789	33.13±16.09			
Albendazole	27.36±1.06(53.92) ^b	22.76±1.19(61.67) ^b	22.94±0.51(61.36) ^b		33.11±16.16			
Tinidizdazole	25.56±5.24(56.95) ^b	28.41±1.98(52.15) ^b	27.44±1.45(53.78) ^b		35.20±15.03			
Ornidazole	23.60±3.55(60.25) ^b	30.04±1.44(49.41) ^b	24.14±1.81(59.34) ^b		34.29±15.65			
Mebendazole	22.44±1.02(62.20) ^b	22.51±2.63(62.09) ^b	23.79±0.92(59.93) ^b		32.03±16.73			
Satranidazole	24.58±2.52(58.60) ^b	24.05±2.86(59.49) ^b	27.05±1.61(54.44) ^b		33.77±15.78			
Concentrations	24.79±3.04	25.39±3.35	24.79±2.16					
Source of Variations	df	Sum of Squares	Mean Squares	F Ratio	Probability	η^2	ηp^2	ω^2
Treatment	5	71.748211	14.349642	1.21	0.3207	0.004	0.112	0.001
Concentration	3	15970.69729	5323.565764	447.44	0.0000 ***	0.951	0.965	0.486
Treat. × Conc.	15	173.328716	11.555248	0.97	0.4984	0.01	0.233	0
Error (B)	48	571.091633	11.897742					
Total	71	16786.86523	236.434722					
Comparison	Std. Error	S.E. Difference	t value 5%	C.Difference				
Treatment	0.99573	1.40818	2.01063	2.83131				
Concentration	0.81301	1.14977	2.01063	2.31176				
Treat. × Conc.	1.99146	2.81635	2.01063	5.66263				

Significant at 5% level; ** Significant at 1% level; *** Significant at 0.1% level; (^b) % reduction in mortality in parantheses

Table 15: Efficacy of different of benzimidazole derivatives on suppression of infection in moth stage of CSR2 breed.

Treatment	% infection and reduction in infection in due to treatment of different concentrations				Treatment			
	0.25%	0.50%	1.00%	Control				
Metronidazole	31.01±3.48(51.98) ^b	26.13±1.24(59.64) ^b	24.82±0.55(61.57) ^b	64.59±2.32	36.64±17.13			
Albendazole	24.22±2.36(62.50) ^b	18.61±1.89(71.18) ^b	15.32±1.01(76.28) ^b		30.69±20.78			
Tinidizdazole	30.27±2.36(53.13) ^b	25.57±3.16(60.41) ^b	21.54±1.35(66.65) ^b		35.49±17.99			
Orinidazole	23.29±0.62(63.94) ^b	21.19±3.03(67.19) ^b	19.85±1.63(69.26) ^b		32.23±19.64			
Mebendazole	15.82±1.67(75.50) ^b	13.98±1.12(78.35) ^b	14.36±2.65(77.76) ^b		27.19±22.63			
Satranidazole	23.59±1.44(63.47) ^b	24.71±0.80(61.74) ^b	21.22±1.18(67.14) ^b		33.53±18.82			
Concentrations	24.70±5.59	21.70±4.80	19.52±3.96					
Source of Variations	df	Sum of Squares	Mean Squares	F Ratio	Probability	η^2	ηp^2	ω^2
Treatment	5	703.737872	140.747574	31.17	0.0000 ***	0.02 7	0.765	0.025
Concentration	3	24761.93306	8253.977685	1828.13	0.0000 ***	0.95 2	0.991	0.487
Treat. × Conc.	15	333.51449	22.234299	4.92	0.0000 ***	0.01 3	0.606	0.01
Error (B)	48	216.719111	4.514981					
Total	71	26015.9043	366.421187					
Comparison	Std. Error	S.E. Difference	t value 5%	C.Difference				
Treatment	0.61339	0.86747	2.01063	1.74415				
Concentration	0.50083	0.70828	2.01063	1.42409				
Treat. × Conc.	1.22678	1.73493	2.01063	3.4883				

Significant at 5% level; ** Significant at 1% level; *** Significant at 0.1% level; (^b) % reduction in mortality in parantheses

Table 16: Efficacy of quine derivatives in disease control/suppression of Lamerin microsporidian in Lamerin breed.

Treatment	% mortality and disease reduction due to treatment of different concentrations				Treatment			
	0.25%	0.50%	1.00%	Control				
Primiquine	1.66±1.15(82.20) ^b	0.66±0.57(92.92) ^b	0.33±0.57(96.46) ^b	9.33±0.57	3.00±3.90			
Sapraquine	0.00±0.00(100.0) ^b	0.00±0.00(100.00) ^b	0.00±0.00(100.00) ^b		2.50±4.14			
Chloroquine	1.33±0.57(85.74) ^b	1.33±0.57(85.74) ^b	0.33±0.57(96.46) ^b		3.08±3.82			
Concentrations	1.00±1.00	0.77±0.66	0.33±0.50					
Source of Variations	df	Sum of Squares	Mean Squares	F Ratio	Probability	η ²	ηp ²	ω ²
Treatment	2	2.388889	1.194444	3.07	0.0649	0.005	0.204	0.003
Concentration	3	504.75	168.25	432.64	0.0000 ***	0.97	0.982	0.491
Treat. × Conc.	6	3.833333	0.638889	1.64	0.1788	0.007	0.291	0.003
Error (B)	24	9.333333	0.388889					
Total	35	520.305542	14.865873					
Comparison	Std. Error	S.E. Difference	t value 5%	C.Difference				
Treatment	0.18002	0.25459	2.06389	0.52544				
Concentration	0.20787	0.29397	2.06389	0.60673				
Treat. × Conc.	0.36004	0.50918	2.06389	1.05088				

Significant at 5% level; ** Significant at 1% level ; *** Significant at 0.1% level; (^b) % reduction in mortality in parantheses

Table 17: Efficacy of quine derivatives in disease control/suppression of Lamerin microsporidian in CSR2 breed.

Treatment	% mortality and disease reduction due to treatment of different concentrations				Treatment			
	0.25%	0.50%	1.00%	Control				
Primiquine	2.67±1.53(80.46) ^b	1.67±0.58(87.78) ^b	0.67±1.16(95.00) ^b	13.67±1.16	4.67±5.57			
Sapraquine	0.00±0.00(100.0) ^b	0.00±0.00(100.0) ^b	0.00±0.00(100.0) ^b		4.25±5.77			
Chloroquine	2.67±0.58(80.46) ^b	2.33±0.58(82.95) ^b	0.67±1.16(95.00) ^b		4.83±5.44			
Concentrations	1.78±1.56	1.78±0.83	1.11±1.05					
Source of Variations	df	Sum of Squares	Mean Squares	F Ratio	Probability	η^2	ηp^2	ω^2
Treatment	2	2.166667	1.083333	1.15	0.3344	0.002	0.087	0
Concentration	3	992.75	330.916667	350.38	0.0000 ***	0.959	0.978	0.488
Treat. × Conc.	6	17.166667	2.861111	3.03	0.0238 *	0.017	0.431	0.011
Error (B)	24	22.666667	0.944444					
Total	35	1034.75	29.564286					
Comparison	Std. Error	S.E. Difference	t value 5%	C.Difference				
Treatment	0.28054	0.39675	2.06389	0.81884				
Concentration	0.32394	0.45812	2.06389	0.94551				
Treat. × Conc.	0.56108	0.79349	2.06389	1.63768				

Significant at 5% level; ** Significant at 1% level; *** Significant at 0.1% level; (^b) % reduction in mortality in parantheses

Table 18: Efficacy of different quine derivatives on suppression of infection in moth stage of Lamerin breed.

Treatment	% infection and reduction in infection in due to treatment of different concentrations				Treatment			
	0.25%	0.50%	1.00%	Control				
Primiquine	26.54±4.76 (55.30) ^b	28.52±1.19(51.97) ^b	27.21±0.38(54.17) ^b	59.38±5.69	35.41±14.82			
Sapraquine	24.67±3.21(58.45) ^b	23.72±1.28(60.05) ^b	24.21±2.25(59.22) ^b		32.99±16.20			
Chloroquine	26.49±4.36(55.38) ^b	25.15±4.41(57.64) ^b	24.56±3.57(58.63) ^b		33.89±15.87			
Concentrations	25.90±3.72	25.79±3.19	25.32±2.55					
Source of Variations	df	Sum of Squares	Mean Squares	F Ratio	Probability	η^2	ηp^2	ω^2
Treatment	2	35.824342	17.912171	1.13	0.3382	0.004	0.086	0.001
Concentration	3	7670.97471	2556.99157	161.96	0.0000 ***	0.946	0.953	0.483
Treat. × Conc.	6	23.561348	3.926891	0.25	0.9551	0.003	0.059	-0.009
Error (B)	24	378.902975	15.787624					
Total	35	8109.262695	231.69322					
Comparison	Std. Error	S.E. Difference	t value 5%	C.Difference				
Treatment	1.14701	1.62212	2.06389	3.34787				
Concentration	1.32445	1.87306	2.06389	3.86579				
Treat. × Conc.	2.29402	3.24424	2.06389	6.69574				

Significant at 5% level; ** Significant at 1% level ; *** Significant at 0.1% level; (^b) % reduction in mortality in parantheses

Table 19: Efficacy of different quinine derivatives of suppression of infection in moth stage of CSR2 breed.

Treatment	% infection and reduction in infection due to treatment of different concentration				Treatment			
	0.25%	0.50%	1.00%	Control				
Primiquine	22.18±1.75(67.14) ^b	19.56±1.12(71.02) ^b	18.17±2.54(73.08) ^b	67.51±3.55	31.85±21.65			
Sapraquine	15.74±1.48(76.68) ^b	17.94±3.57(73.42) ^b	20.28±1.69(69.96) ^b		30.37±22.58			
Chloroquine	22.50±1.08(66.67) ^b	21.71±0.79(67.84) ^b	19.20±2.65(71.55) ^b		32.73±21.10			
Concentrations	20.14±3.54	19.74±2.52	19.22±2.22					
Source of Variations	df	Sum of Squares	Mean Squares	F Ratio	Probability	η^2	ηp^2	ω^2
Treatment	2	34.144313	17.072156	2.73	0.0857	0.00 2	0.18 5	0.00 1
Concentration	3	15432.27479	5144.09159	821.53	0.0000 ****	0.98 3	0.99	0.49 5
Treat. × Conc.	6	81.172464	13.528744	2.16	0.0831	0.00 5	0.35 1	0.00 3
Error (B)	24	150.278752	6.261615					
Total	35	15697.87012	448.510575					
Comparison	Std. Error	S.E. Difference	t value 5%	C.Difference				
Treatment	0.72236	1.02157	2.06389	2.1084				
Concentration	0.83411	1.17961	2.06389	2.43457				
Treat. × Conc.	1.44472	2.04314	2.06389	4.21681				

Significant at 5% level; ** Significant at 1% level ; **** Significant at 0.1% level; (^b) % reduction in mortality in parantheses

Table 20: Efficacy of different benzimidazole derivatives on the economic characters of Lamerin breed.

Treatment	Conc. (%)	ERR (%)	Larval wt. (g) (10larvae)	SCW (g)	SSW (g)	SR%
Metronidazole	0.25	95.33 ± 1.16	25.77 ± 0.74	0.94 ± 0.10	0.13 ± 0.02	13.51 ± 0.44
	0.50	95.00 ± 1.00	26.07±0.87	0.97±0.03	0.13±0.01	13.05±0.98
	1.00	95.67 ± 1.53	25.90±0.56	0.93±0.10	0.13±0.02	13.90±0.42
Albendazole	0.25	95.00 ±1.16	26.35±1.05	1.00±0.10	0.12±0.02	13.67±0.58
	0.50	96.67±1.53	24.92±0.20	0.99±0.01	0.13±0.01	13.41±1.02
	1.00	97.33 ±1.66	24.93±1.31	0.99±0.02	0.13±0.02	13.50±1.32
Tinidazole	0.25	94.33±2.08	25.49±1.86	0.96±0.06	0.13±0.02	13.20±1.56
	0.50	95.00±1.00	24.70±2.71	1.00±0.01	0.13±0.01	13.33±0.58
	1.00	96.00±1.00	25.58±0.99	1.01±0.01	0.13±0.01	13.24±1.08
Ornidazole	0.25	94.67±0.58	25.95±1.52	0.99±0.01	0.12±0.01	12.50±0.55
	0.50	94.33±1.16	25.64±1.80	0.97±0.02	0.13±0.01	13.39±0.83
	1.00	96.67±1.16	25.54±0.44	1.03±0.01	0.15±0.01	14.05±0.62
Mebendazole	0.25	98.00±0.58	24.89±2.29	1.00±0.01	0.14±0.01	13.71±1.12
	0.50	97.67±0.58	25.40±2.26	0.93±0.04	0.12±0.01	12.50±0.47
	1.00	96.67±0.58	24.43±2.53	0.94±0.05	0.13±0.01	13.44±0.61
Satrinidazole	0.25	96.33±1.53	24.69±1.97	0.97±0.02	0.13±0.01	13.34±0.76
	0.50	95.33±0.58	24.67±0.88	0.95±0.05	0.13±0.01	13.67±0.54
	1.00	97.33±0.58	23.80±2.14	0.96±0.06	0.13±0.01	13.54±0.44
Control	-	84.67±0.58	25.67±1.14	0.99±0.01	0.13±0.01	13.08 ±0.88
CD@5%Treatment		0.80935	1.251	0.032	0.00982	0.69805
CD@5%Concc		0.66083	1.021	0.026	0.00802	0.56995
CD@5%Treat x Conc.		1.61871	2.502	0.064	0.01964	1.3961

*: Significant at 5%; **Significant at 1%; ***Significant at 0.1%

Table 21: Efficacy of different benzimidazole derivatives on the economic characters of CSR2 breed.

Treatment	Conc. (%)	ERR (%)	Larval wt. (g) (10 larvae)	SCW (g)	SSW (g)	SR%
Metronidazole	0.25	93.67±2.08	33.40±0.53	1.67±0.06	0.37±0.02	22.26±0.87
	0.50	93.00±1.00	33.73±0.76	1.58±0.02	0.350±0.01	22.15±0.44
	1.00	94.00±1.73	33.30±0.52	1.59±0.02	0.34±0.03	21.85±1.91
Albendazole	0.25	93.67±0.58	33.33±0.58	1.61±0.01	0.36±0.00	22.61±0.33
	0.50	95.00±1.73	33.23±0.15	1.61±0.05	0.36±0.03	22.75±1.24
	1.00	91.33±0.58	33.40±0.53	1.66±0.00	0.39±0.00	23.69±0.35
Tinidazole	0.25	92.67±2.52	33.50±0.56	1.59±0.02	0.35±0.01	21.96±0.91
	0.50	92.67±2.52	32.80±0.20	1.59±0.02	0.37±0.01	23.21±0.90
	1.00	94.33±1.53	33.73±0.76	1.56±0.05	0.30±0.01	19.70±0.52
Ornidazole	0.25	93.00±2.52	33.30±0.52	1.65±0.02	0.36±0.02	21.96±1.21
	0.50	92.67±1.16	33.33±0.58	1.63±0.03	0.37±0.01	23.21±0.29
	1.00	94.00±1.53	33.23±0.15	1.60±0.01	0.35±0.00	19.70±0.88
Mebendazole	0.25	92.67±0.58	33.40±0.53	1.64±0.04	0.39±0.01	23.98±0.63
	0.50	93.00±1.73	33.07±0.12	1.56±0.05	0.35±0.04	20.53±1.76
	1.00	93.00±2.65	32.47±0.81	1.58±0.02	0.35±0.01	22.15±0.84
Satrinidazole	0.25	92.33±0.58	33.37±0.55	1.59±0.02	0.36±0.01	22.59±0.46
	0.50	92.67±0.58	32.37±0.55	1.61±0.01	0.36±0.01	22.82±0.88
	1.00	92.67±0.58	32.33±0.58	1.61±0.05	0.37±0.02	22.96±0.98
Control	-	80.00±1.00	32.83±0.38	1.57±0.02	0.35±0.02	22.44±1.26
CD@5% Treatment		1.13227	0.41235	0.02344*	0.01771	0.85693
CD@5% Concentration		0.92449***	0.33668*	0.01914***	0.01446	0.69968
CD@5% Treat. × Conc.		2.26454	0.8247	0.04687**	0.03541*	1.71385**

*: Significant at 5%; **Significant at 1%; ***Significant at 0.1%

Table 22: Efficacy of different quinine derivatives on the economic characters of Lamerin breed.

Treatment	Conc. (%)	ERR (%)	Larval wt. (g) (10 larvae)	SCW (g)	SSW (g)	SR%
Primaquine	0.25	95.33±1.53	25.50±0.63	0.95±0.07	0.13±0.08	13.21±0.22
	0.50	97.00±0.00	25.85±0.81	0.99±0.00	0.13±0.01	13.71±1.12
	1.00	98.00±1.00	26.43±0.36	0.98±0.06	0.14±0.07	14.50±1.29
Sapraquine	0.25	98.67±0.58	24.54±0.69	0.96±0.03	0.12±0.04	12.47±0.50
	0.50	97.00±1.00	25.71±1.53	0.97±0.02	0.13±0.02	13.01±0.33
	1.00	96.33±0.58	24.72±1.37	0.99±0.02	0.13±0.02	13.40±1.24
Chloroquine	0.25	95.67±0.58	25.34±0.23	1.00±0.03	0.13±0.04	13.33±0.58
	0.50	95.33±0.58	25.80±1.85	0.99±0.01	0.13±0.01	13.08±0.88
	1.00	97.67±0.58	25.30±1.48	0.98±0.02	0.13±0.02	13.17±0.76
Control	-	84.67 ± 0.58	25.67±1.14	0.99±0.01	0.13±0.01	13.08±0.88
CD@5% Treatment		0.64353*	0.95505	0.02881	0.00881	0.72472
CD@5% Concentration		0.74308***	1.10279	0.03327	0.00327	0.83683
CD@5% Treatment × Concentration		1.28706***	1.9101	0.05763	0.02763	1.44944

*: Significant at 5%; **Significant at 1%; ***Significant at 0.1%

Table 23: Efficacy of different quine derivatives on the economic characters of CSR2 breed.

Treatment	Conc. (%)	ERR (%)	Larval wt. (g) (10 larvae)	SCW (g)	SSW (g)	SR%
Primaquine	0.25	91.67±1.16	32.87±0.58	1.61±0.00	0.35±0.01	21.90±0.69
	0.50	93.67±0.58	33.00±1.00	1.64±0.03	0.35±0.04	21.31±2.39
	1.00	95.33±0.58	33.20±0.00	1.62±0.02	0.37±0.02	23.10±0.94
Sapraquine	0.25	97.33±0.58	32.67±1.16	1.62±0.03	0.36±0.00	22.43±0.13
	0.50	94.67±0.58	33.07±0.12	1.61±0.04	0.36±0.03	22.54±1.35
	1.00	95.33±0.58	32.47±0.81	1.62±0.03	0.37±0.01	23.20±0.26
Chloroquine	0.25	93.33±0.58	33.37±0.55	1.62±0.03	0.37±0.01	22.74±0.47
	0.50	93.67±1.16	32.37±0.55	1.67±0.01	0.38±0.00	23.15±0.31
	1.00	93.67±2.08	32.33±0.58	1.58±0.01	0.34±0.01	21.93±0.49
Control	-	80.00±1.00	32.83±0.38	1.57±0.01	0.34±0.00	21.82±0.18
CD@5% Treatment		0.84258***	0.5275	0.0226	0.01583	0.75467
CD@5% Concentration		0.97293***	0.6091	0.0261***	0.01827*	0.87141
CD@5% Treatment × Concentration		1.68516***	1.055	0.0452	0.03165	1.50933

*: Significant at 5%; **Significant at 1%; ***Significant at 0.1%

Table 24: Screening of extracts from selected plants against Lamerin microsporidia.

Scientific Name	Common Name	Plant part used	Concentrations	Effective
<i>Ammi copticum</i>	Ajowan	Seeds	1.00	-
			2.00	-
			3.00	-
<i>Citrus paradisi</i>	Grape seeds	Seeds	1.00	-
			2.00	-
			3.00	-
<i>Myrtus caryophyllus</i>	Clove	Pedicel	1.00	+
			2.00	+
			3.00	-
<i>Phyllanthus niruri</i>	Phyllanthus	Leaves	1.00	+
			2.00	-
			3.00	-
<i>Lawsonia alba</i>	Mehandi	Leaves	1.00	+
			2.00	+
			3.00	+
<i>Curcuma longa</i>	Turmeric	Rhizome	1.00	+
			2.00	+
			3.00	+
Control	-	-	-	+

+: Ineffective -: Effective

Table25: Efficacy of botanicals in disease control/suppression of Lamerin microsporidian in Lamerin breed.

Treatment	% mortality and disease reduction due to treatment of different concentrations				Treatment			
	1.00%	2.00%	3.00%	Control		η^2	ηp^2	ω^2
<i>A. copticum</i>	0.33±0.58(96.70) ^b	0.00±0.00(100.0) ^b	0.00±0.00(100.0) ^b	10.00±1.00	2.58±4.50			
<i>C. paradesi</i>	0.00±0.00(100.0) ^b	0.00±0.00(100.0) ^b	0.00±0.00(100.0) ^b		2.50±4.54			
<i>M.caryophyllus</i>	1.00±0.58(90.00) ^b	0.67±0.58(93.33) ^b	0.67±0.58(93.33) ^b		3.08±4.21			
<i>P. niruri s</i>	1.33±0.58(86.70) ^b	1.00±0.58(90.00) ^b	0.33±0.58(96.70) ^b		3.17±4.17			
<i>L. alba</i>	2.67±0.58(73.30) ^b	1.67±0.58(83.33) ^b	1.33±0.58(86.70) ^b		3.92±3.75			
<i>C.longa</i>	1.67±0.58(83.33) ^b	1.33±0.58(86.70) ^b	0.67±0.58(93.33) ^b		3.42±4.03			
Concentration	1.17±0.99	0.78±0.73	0.50±0.62					
Source of Variations	df	Sum of Squares	Mean Squares	F Ratio	Probability	η^2	ηp^2	ω^2
Treatment	5	16.777778	3.355556	8.33	0.0000 ***	0.014	0.465	0.012
Concentration	3	1143	381	945.93	0.0000 ***	0.963	0.983	0.49
Treatment × Conc.	15	8	0.533333	1.32	0.2251	0.007	0.293	0.002
Error (B)	48	19.333333	0.402778					
Total	71	1187.111084	16.719874					
Comparison	Std. Error	SE Diff.	t value 5%	C.Difference				
Treatment	0.18321	0.25909	2.01063	0.52094				
Concentration	0.14959	0.21155	2.01063	0.42535				
Treatment × Conc.	0.36641	0.51819	2.01063	1.04188				

Significant at 5% level; ** Significant at 1% level; *** Significant at 0.1% level; (^b) % reduction in mortality in parantheses

Table 26: Efficacy of botanicals in disease control/suppression of Lamerin microsporidian in CSR2 breed

Treatment	% mortality and disease reduction due to treatment of different concentrations				Treatment			
	1.00%	2.00%	3.00%	Control				
<i>A. copticum</i>	0±0.00(100.0) ^b	0±0.00(100.0) ^b	0±0.00(100.0) ^b	12.33±0.58	3.08±5.58			
<i>C. paradesi</i>	0.00±0.58 (86.44) ^b	0±0.00(100.0) ^b	0±0.00(100.0) ^b		3.50±5.39			
<i>M.caryophyllus</i>	1.33±0.58(89.21) ^b	1.00±0.0(100.0) ^b	0±0.00(100.0) ^b		3.67±5.26			
<i>P. niruri s</i>	1.67±0.58(86.44) ^b	0±0.0(100.0) ^b	0±0.00(100.0) ^b		3.50±5.39			
<i>L. alba</i>	2.00±0.58(83.77) ^b	1.67±0.58(86.44) ^b	0±0.00(100.0) ^b		4.00±5.10			
<i>C.longa</i>	2.00±0.58(83.77) ^b	2.00±1.00(83.77) ^b	0.67±0.58(94.56) ^b		4.25±4.94			
Concentration	1.44±0.78	0.78±0.94	0.11±0.32					
Source of Variations	df	Sum of Squares	Mean Squares	F Ratio	Probability	η^2	ηp^2	ω^2
Treatment	5	10.166667	2.033333	10.46	0.0000 ***	0.005	0.521	0.005
Concentration	3	1818.666667	606.222222	3117.71	0.0000 ***	0.983	0.995	0.496
Treatment × Conc.	15	11.833333	0.788889	4.06	0.0001 ***	0.006	0.559	0.005
Error (B)	48	9.333333	0.194444					
Total	71	1850	26.056338					
Comparison	Std. Error	SE Difference	t value 5%	C.Difference				
Treatment	0.12729	0.18002	2.01063	0.36195				
Concentration	0.10393	0.14699	2.01063	0.29553				
Treatment × Conc.	0.25459	0.36004	2.01063	0.72391				

Significant at 5% level; ** Significant at 1% level; *** Significant at 0.1% level; (^b) % reduction in mortality in parantheses

Table 27: Efficacy of different botanicals on suppression of infection in moth stage of Lamerin breed

Treatment	% infection and reduction in infection due to treatment of different concentrations				Treatment			
	1.00%	2.00%	3.00%	Control				
<i>A. copticum</i>	18.65±0.81(70.77)	17.01±1.67(71.51)	13.51±0.55(78.83)	63.82±6.08	28.25±21.71			
<i>C. paradesi</i>	21.02±1.62(67.06)	18.71±0.76(70.68)	15.58±1.47(75.58)		29.78±20.81			
<i>M.caryophyllus</i>	21.56±0.92(66.21)	18.49±1.05(71.02)	18.49±1.84(71.02)		30.59±20.27			
<i>P. niruri s</i>	21.30±0.79(66.62)	19.08±0.89(70.08)	18.16±1.26(71.54)		30.59±20.25			
<i>L. alba</i>	26.89±3.40(57.86)	27.00±4.67(57.69)	23.55±4.34(63.09)		35.32±17.71			
<i>C.longa</i>	29.41±1.41(53.91)	25.00±2.24(60.82)	21.66±1.04(66.06)		34.97±17.86			
Concentration	23.14±4.12	20.88±4.29	18.49±3.92					
Source of Variations	df	Sum of Squares	Mean Squares	F Ratio	Probability	η^2	ηp^2	ω^2
Treatment	5	501.260138	100.252028	8.03	0.0000 ***	0.019	0.455	0.016
Concentration	3	25130.86509	8376.95503	670.88	0.0000 ***	0.951	0.977	0.487
Treatment × Conc.	15	207.014348	13.800957	1.11	0.3773	0.008	0.257	0.001
Error (B)	48	599.349967	12.486458					
Total	71	26438.49023	372.373102					
Comparison	Std. Error	SE.Difference	t value 5%	C.Difference				
Treatment	1.02007	1.44259	2.01063	2.90052				
Concentration	0.83288	1.17787	2.01063	2.36826				
Treatment × Conc.	2.04014	2.88519	2.01063	5.80103				

*: Significant at 5%; **Significant at 1%; ***Significant at 0.1%

Table 28: Efficacy of different botanicals on suppression of infection in moth stage of CSR2 breed.

Treatment	% infection and reduction in infection due to treatment of different concentrations					Treatment		
	1.00%	2.00%	3.00%	Control				
<i>A. copticum</i>	12.16±0.96(80.65)	10.37±1.04(83.50)	12.88±0.68(79.51)	62.86±1.63	24.57±23.13			
<i>C. paradesi</i>	12.96±1.14(79.38)	10.07±1.01(83.98)	10.96±1.59(82.56)		24.21±23.36			
<i>M.caryophyllus</i>	17.22±1.32(72.60)	18.34±0.71(70.82)	19.02±1.15(69.74)		29.36±20.24			
<i>P. niruri s</i>	20.62±0.36(67.19)	18.09±2.24(71.22)	14.53±0.96(76.88)		29.02±20.57			
<i>L. alba</i>	21.13±1.17(66.38)	21.90±0.56(65.16)	18.19±2.23(71.06)		31.02±19.30			
<i>C.longa</i>	22.21±1.36(64.66)	20.21±0.92(67.84)	19.31±0.85(69.28)		31.15±19.18			
Concentration	17.72±4.18	16.50±4.86	15.82±3.50					
Source of Variations	df	Sum of Squares	Mean Squares	F Ratio	Probability	η^2	ηp^2	ω^2
Treatment	5	573.362878	114.672576	64.19	0.0000 ***	0.019	0.87	0.019
Concentration	3	28822.92948	9607.643159	5378.4	0.0000 ***	0.968	0.997	0.492
Treatment × Conc.	15	278.37458	18.558305	10.39	0.0000 ***	0.009	0.765	0.008
Error (B)	48	85.74423	1.786338					
Total	71	29760.41211	419.160734					
Comparison	Std. Error	SE Difference	t value 5%	C.Difference				
Treatment	0.38583	0.54564	2.01063	1.09708				
Concentration	0.31503	0.44551	2.01063	0.89576				
Treatment × Conc.	0.77165	1.09128	2.01063	2.19416				

*: Significant at 5%; **Significant at 1%; ***Significant at 0.1%

Table 29: Efficacy of different botanicals on the economic characters of Lamerin breed.

Treatment	Conc. (%)	ERR (%)	Larval wt. (g) (10 larvae)	SCW (g)	SSW (g)	SR%
<i>A. copticum</i>	1	98.33±1.16	26.15±0.99	0.97±0.03	0.13±0.01	13.73±0.84
	2	98.67±0.58	26.33±0.58	0.99±0.01	0.14±0.01	13.85±0.51
	3	98.67±0.58	27.40±1.22	1.00±0.00	0.14±0.01	14.00±1.00
<i>C. paradisi</i>	1	98.00±1.00	27.13±1.10	0.99±0.01	0.14±0.02	13.75±1.40
	2	98.00±1.00	25.87±1.86	0.97±0.01	0.13±0.01	13.11±0.55
	3	98.33±0.58	26.20±0.35	0.86±0.04	0.12±0.01	13.51±0.11
<i>M. caryophyllus</i>	1	97.33±0.58	25.70±0.78	1.00±0.01	0.13±0.01	13.33±0.58
	2	97.33±1.16	25.77±0.59	1.01±0.01	0.14±0.01	13.57±0.98
	3	97.33±0.58	26.20±0.20	0.99±0.01	0.13±0.01	12.83±0.51
<i>P. niruri</i>	1	97.00±1.00	26.87±0.90	0.97±0.02	0.13±0.01	13.74±0.35
	2	96.00±2.00	24.87±0.23	1.03±0.01	0.14±0.01	13.30±0.97
	3	95.33±2.08	25.53±0.81	1.00±0.01	0.14±0.01	13.71±0.50
<i>L. alba</i>	1	95.33±1.16	25.60±1.25	0.93±0.04	0.12±0.01	12.84±0.55
	2	96.33±0.58	25.40±0.85	0.94±0.05	0.12±0.01	12.84±0.55
	3	95.67±1.16	26.00±1.00	0.97±0.03	0.13±0.01	13.57±0.72
<i>C. longa</i>	1	96.33±1.16	25.97±1.04	0.98±0.00	0.13±0.01	13.60±0.59
	2	96.00±1.00	25.53±1.52	0.92±0.06	0.13±0.01	13.70±0.38
	3	97.67±1.16	25.00±0.78	1.00±0.03	0.13±0.01	13.33±0.58
Control	-	86.67±0.58	25.51±1.31	0.97±0.02	0.13±0.01	13.01±0.33
CD@5% Treatment		0.82652***	0.88035	0.01968***	0.0067	0.51412
CD@5% Concentration		0.67485***	0.7188	0.01607	0.00547	0.41978
CD@5% Treatment × Concentration		1.65303	1.7607	0.03937***	0.0134	1.02825

*: Significant at 5%; **Significant at 1%; ***Significant at 0.1%

Table 30: Efficacy of different botanicals on the economic characters of CSR2 breed

Treatment	Conc. (%)	ERR (%)	Larval wt. (g) (10 larvae)	SCW (g)	SSW (g)	SR%
<i>A. copticum</i>	1	98.67±0.58	33.80±0.53	1.63±0.02	0.36±0.01	22.28±0.65
	2	96.33±0.58	33.47±1.03	1.62±0.02	0.37±0.00	22.95±0.05
	3	98.33±1.16	33.93±0.81	1.60±0.00	0.37±0.01	23.28±0.68
<i>C. paradisi</i>	1	97.67±0.58	33.50±0.56	1.64±0.03	0.37±0.01	22.53±0.95
	2	99.33±0.58	32.80±0.20	1.55±0.05	0.37±0.01	21.88±2.53
	3	97.33±1.16	33.73±0.76	1.58±0.01	0.34±0.01	21.52±0.68
<i>M. caryophyllus</i>	1	96.67±1.53	33.30±0.52	1.59±0.02	0.34±0.02	21.54±1.03
	2	96.33±0.58	33.33±0.58	1.60±0.00	0.36±0.00	22.82±0.28
	3	96.33±0.58	33.23±0.15	1.61±0.04	0.38±0.02	23.59±0.60
<i>P. niruri</i>	1	95.33±1.16	33.40±0.53	1.58±0.01	0.35±0.00	22.36±0.12
	2	97.67±0.58	33.07±0.12	1.66±0.00	0.34±0.00	20.88±0.35
	3	96.33±0.58	32.47±0.81	1.61±0.00	0.35±0.00	21.72±0.64
<i>L. alba</i>	1	94.67±0.58	33.37±0.55	1.64±0.03	0.35±0.03	21.53±1.70
	2	94.33±0.58	32.37±0.55	1.62±0.02	0.38±0.01	23.35±0.64
	3	97.00±1.00	32.33±0.58	1.62±0.03	0.37±0.02	23.24±1.20
<i>C. longa</i>	1	96.00±1.00	32.87±0.58	1.61±0.04	0.39±0.01	21.69±2.50
	2	95.67±1.53	33.00±1.00	1.62±0.03	0.36±0.02	23.00±0.74
	3	96.67±1.53	33.20±0.58	1.62±0.03	0.35±0.01	21.52±0.85
Control	-	82.67±0.58	32.67±0.58	1.67±0.017	0.36±0.01	21.75±0.70
CD@5% Treatment		0.71742***	0.64364	0.02229	0.01298	0.85276
CD@5% Concentration		0.58577***	0.52553	0.0182***	0.0106	0.69628
CD@5% Treatment × Concentration		1.43483***	1.28728	0.04458*	0.02596*	1.70553

*: Significant at 5%; **Significant at 1%; ***Significant at 0.1%