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Effect of 3-Indole Butyric Acid (3IBA) on the Polyvoltine Silkworm, the Pure Mysore Breed of *Bombyx mori* L.

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Abstract

Effects of topical application of 100, 200 and 300 ng/ml of 3-indole butyric acid (3IBA) on larval parameters were studied in polyvoltine Pure Mysore breed of *B. mori*. Each concentration was administered independently, at 36h to III, IV & V instars, at 48h to IV & V instars and at 72h to V instar larvae. Of the various dosages used, the repeated applications of 100ng of 3-IBA at 36h to III, IV & V instars resulted in a significant increase in larval weight, silk gland weight, cocoon shell weight and fecundity and a significant decrease in larval duration and cocooning percentage when compared with the corresponding parameters of the untreated controls.

Introduction

It has been suggested that plant hormones may influence the appetite, nutrition and absorption of plant materials in the phytophagous insects and therefore may influence their physiology and development (Neumann, 1982). It has been reported that dietary supplimentation of indole-3-butyric acid reduced the larval weight, number of eggs laid and hatching in *Heliothis zea* (Guerra, 1970). Kamada and Ito (1984) reported that the feeding of indole-3-acetic acid or gibberelic acid along with the artificial diet is shown to increase the body weight and feeding indole-3-acetic acid (IAA) or gibberelic acid (GA_3) along with the mulberry leaves or its topical application on 2nd or 3rd day of IV instar is shown to increase the cocoon weight in the silkworm, *Bombyx mori*. However, there are no reports on the effects of 3-indole butyric acid (3IBA) on economic parameters of the silkworm, *B. mori*. Hence in the present study an attempt has been made to study the effect of 3IBA on some economic parameters of the polyvoltine Pure Mysore breed of *B. mori*.

Materials and Methods

The polyvoltine silkworms were reared in the laboratory following the improved method of silkworm rearing (Krishnaswami, 1978). The silkworm were maintained on fresh K_2 mulberry leaves. The III, IV and V instar larvae were grouped into different experimental groups. Each group consisted of 20 worms of five replications. The temperature 25±1°C and humidity 75~80% were recorded during the experiment.

3-indole butyric acid (3-IBA-M/s Loba Chemicals, Bombay) was dissolved in a small quantity of distilled water and diluted to 100, 200 and 300 ng/ml. Each concentration was topically applied at 36h to III, IV and V instars, at 48h to IV and V instars and at 72h to V instar larvae. Distilled water treated and untreated controls were also maintained. After the treatments, precocooning and post cocooning parameters were recorded. These experiments were conducted twice to conclude the results. The data collected were statistically analysed. The percent

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index was calculated for different parameters over those of corresponding parameters of untreated controls.

Results and Discussion

The data on the effects of 3IBA on larval duration, larval weight, cocoon weight, cocoon shell weight and cocoon shell ratio in both the sexes and fecundity are summerised in tables 1 to 3.

Larval duration:

The results obtained in the present study showed that larval duration was decreased significantly ($p<0.05$) in all the larval groups treated with 3IBA as compared to that of untreated controls. Amongst the treatment groups, repeated application of all doses of 3IBA at 48h to IV and V instar larvae resulted in a maximum decrease (34h) of larval duration. Guerra (1970) reported that dietary supplimentation of indole-3 butyric acid resulted in an increase in larval duration in *Heliothis zea*. The results obtained in the present study does not support the views of Guerra (1970). The reduction in larval duration obtained in the present study might possibly be due to th increased synthesis of molting hormone since the plant growth hormone/regulators are reported to alter the rate of synthesis of insect molting hormone (Neumann, 1982).

Larval weight:

A significant increase ($p<0.05$) in the larval weight was obtained in all treatments as compared to that of untreated controls. However, increase in larval weight (28%) was recorded with repeated application of 100 and 300ng of IBA at 36h to III, IV and V instar larvae. Guerra (1970) reported that dietary supplimentation of 3IBA decreased the larval weight in *Heliothis zea*. But Kamada & Ito (1984) reported that treatment of IAA or GA_3 increased the larval weight of *B. mori*. The results recorded in the present study supports the views of Kamada & Ito (1974). The improvement of larval weight in the present study might possibly be due to the growth stimulatory effects of 3IBA as suggested by Neumann (1982).

Silkgland weight:

The silkgland weight was increased significantly ($p<0.05$) with the repeated application of all dosages of 3IBA at 36h to III, IV and V instars and at 48h to IV and V instar larvae when compared with the corresponding parameters of the untreated controls. The increase in silkgland weights obtained with the treatment of a single application of all dosages of 3IBA at 72h to V instar larvae were not significant. The silkgland weight was maximum in the larvae treated with repeated application of 300ng of IBA (43%) at 36h to III, IV and V instars as compared to the untreated controls. Neumann (1982) suggested that dietary supplimentation of plant hormones may regulate the insect growth directly by altering the rate of DNA/molting hormone synthesis. The increase in the silkgland weight recorded in the present study might be due to the increased DNA synthesis by the silkgland or might be due to growth stimulatory effect of 3IBA.

Cocoon weight, Cocoon shell weight and Cocoon shell ratio:

A significant increase ($p<0.05$) in male cocoon weight was recorded with the repeated treatment of 300ng of 3IBA at 48h to IV and V instar larvae when compared with corresponding parameters of untreated controls, but the increase in the cocoon weight in both male and female was not significant when compared with the corresponding parameters of other treatments and untreated controls. Cocoon shell weight was significantly increased in both male and female by repeated application of 100 and 200ng of 3IBA at 48h to IV and V instar larvae when compared with untreated controls. The increase in the cocoon weight (10%) and cocoon shell weight (18%) in males and cocoon shell weight (13%) in females was observed in groups in which the silkworms were treated topically with 300ng of 3IBA at 48h to IV and V instars and 100ng of 3IBA at 36h to III, IV and V instar larvae repeatedly. The increase in cocoon weight and cocoon shell weight by 9% and 15% repectively was observed in repeated application of 100ng of 3IBA at 36h to III, IV and V instar larvae when compared with the untreated controls. The results obtained in the present study for male cocoon weight supports the findings of

Table 1. Effect of repeated application of 3 IBA at 36h to III, IV and V instars on larval weight, silk gland weight, larval duration, cocooning and moth emergence percentages, fecundity and cocoon parameters of *Bombyx mori*.

Treatment	Dose (ng/ml)	Maximum larval Weight (g)	Silk gland weight (g)	Larval duration (hr)	Cocooning percentage (%)	Moth Emergence percentage (%)	Fecundity (no)
3 IBA	100	2.235	0.456	656	88.3* 70.33**	88.6 70.38**	435*
		(128)	(136)	(97)	(91)	(96)	(136)
3 IBA	200	2.090	0.460	656	92.0 73.24**	80.8 65.01**	475*
		(120)	(137)	(97)	(95)	(88)	(149)
3 IBA	300	2.229	0.478	656	90.0 71.74**	85.25 68.06**	394*
		(128)	(143)	(97)	(93)	(93)	(123)
Distilled water control		1.797	0.340	680	95.0 77.44**	90.0 71.74**	336
		(103)	(102)	(100)	(98)	(98)	(105)
Untreated control		1.739	0.334	680	97.0 80.92**	92.0 73.99**	318
		(100)	(100)	(100)	(100)	(100)	(100)
SEM± CD at 5%		0.059 ±0.172	0.019 ±0.056	2.4 ±6.94	1.6 ±4.65	1.85 ±5.36	11.12 ±32.22

Treatment	Dose (ng/ml)	Cocoon Parameters					
		Male			Female		
		Cocoon weight (g)	Cocoon shell weight (g)	Cocoon shell ratio (%)	Cocoon weight (g)	Cocoon shell weight (g)	Cocoon shell ratio (%)
3 IBA	100	0.880	0.128*	14.57 22.41**	1.203	0.141*	11.73 20.0**
		(108)	(118)	(109)	(111)	(113)	(103)
3 IBA	200	0.862	0.126*	14.49 22.33**	1.178	0.137	11.66 19.94**
		(106)	(116)	(108)	(109)	(110)	(102)
3 IBA	300	0.879	0.124	14.11 22.05**	1.090	0.111	10.11 19.94**
		(108)	(114)	(105)	(101)	(89)	(88)
Distilled water control		0.853	0.115	13.55 21.57**	1.131	0.123	10.87 19.21**
		(105)	(106)	(101)	(104)	(99)	(95)
Untreated control		0.12	0.108	13.41 21.44**	1.081	0.124	11.42 19.83**
		(100)	(100)	(100)	(100)	(100)	(100)
SEM± CD at 5%		NS	0.003 ±0.010	NS	NS	0.005 ±0.015	NS

*Significant at 5%; **Angular transformed figures; NS=Non significant Percent, increase/decrease over that of untreated control in paranthesis.

Kamada & Ito (1984) obtained with IAA and GA_3. The increase/decrease of cocoon shell ratio is given in tables 1 to 3.

Cocooning and moth emergence percentages: The cocooning percentage was decreased in all the larval groups treated with 3IBA. The results of the present study (Tables 1 to 3) showed that the mortality of larvae in 3IBA-treated groups ranged from 5 to 18%. The moth emergence percentage in general was decreased significantly except in groups treated

Table 2. Effect of repeated application of 3 IBA at 48h to IV and V instars on larval weight, silk gland weight, larval duration, cocooning and moth emergence percentages, fecundity and cocoon parameters of *Bombyx mori*.

Treatment	Dose (ng/ml)	Maximum larval weight (g)	Silk gland weight (g)	Larval duration (hr)	Cocooning percentage (%)	Moth emergence percentage (%)	Fecundity (no)
3 IBA	100	2.075*	0.439*	646*	90.0	88.8	417*
					72.28**	70.65**	
		(119)	(131)	(95)	(93)	(97)	(131)
3 IBA	200	2.139*	0.417*	646*	92.0*	86.9*	375*
					73.9**	69.23**	
		(123)	(124)	(95)	(95)	(94)	(117)
3 IBA	300	1.980*	0.411*	646*	84.0*	76.5*	365*
					67.58**	61.04**	
		(113)	(123)	(95)	(87)	(83)	(114)
Distilled water control		1.797	0.340	680	95.0	90.0	336
					77.44**	71.79**	
		(103)	(101)	(100)	(98)	(98)	(105)
Untreated control		1.739	0.334	680	97.0	92.0	318
					80.92**	73.99**	
		(100)	(100)	(100)	(100)	(100)	(100)
SEM±		0.036	0.019	2.73	1.35	1.44	14.29
CD at 5%		±0.104	±0.055	±7.92	±3.92	±4.17	±41.39

Treatment	Dose (ng/ml)	Cocoon Parameters					
		Male			Female		
		Cocoon weight (g)	Cocoon shell weight (g)	Cocoon shell ratio (%)	Cocoon weight (g)	Cocoon shell weight (g)	Cocoon shell ratio (%)
3 IBA	100	0.879	0.127	14.49	1.142	0.129	11.29
				22.35**			19.6**
		(108)	(117)	(108)	(105)	(104)	(99)
3 IBA	200	0.836	0.117	14.04	1.101	0.120	10.95
				21.96**			19.32**
		(103)	(108)	(105)	(101)	(97)	(96)
3 IBA	300	0.897*	0.116	13.46	1.041	0.117	11.23
				21.48**			19.54**
		(110)	(107)	(100)	(96)	(94)	(98)
Distilled water control		0.853	0.115	13.55	1.131	0.123	10.99
				21.57**			19.21**
		(105)	(106)	(101)	(104)	(99)	(96)
Untreated control		0.812	0.108	13.41	1.082	0.124	11.42
				21.44**			19.73**
		(100)	(100)	(100)	(100)	(100)	(100)
SEM±		0.024	0.004	NS	NS	NS	NS
CD at 5%		±0.070	±0.011				

*Significant at 5%; **Angular transformed figures; NS=Non significant, Percent increase/decrease over that of untreated control in paranthesis.

repeatedly with 100ng of 3 IBA at 36h to III, IV and V instars and at 48h to IV and V instars and with single application of 200 and 300ng of 3 IBA at 72h to V instar larvae (Tables 1 to 3).

Fecundity:

The fecundity was increased significantly ($p<0.05$) in all treatments of 3IBA when compared with that of untreated controls. The maximum increase in fecundity (49%) was obtained with repeated applications of 200ng of 3IBA at 36h to III, IV and V

Table 3. Effect of single application of 3 IBA at 72h to V instar on larval weight, silkgland weight, larval duration, cocooning and moth emergence percentages, fecundity and cocoon parameters of *Bombyx mori*.

Treatment	Dose (ng/ml)	Maximum larval weight (g)	Silk gland weight (g)	Larval duration (hr)	Cocooning percentage (%)	Moth emergence percentage (%)	Fecundity (no)
3 IBA	100	1.983*	0.392	206	90.0* 71.87**	90.0* 70.55**	426*
		(114)	(117)	(95)	(93)	(98)	(134)
3 IBA	200	2.024*	0.371	206	80.0* 63.50**	91.0 71.54**	427*
		(116)	(111)	(95)	(82)	(99)	(134)
3 IBA	300	1.986*	0.350	206	82.5* 65.36**	93.0 75.06**	404*
		(114)	(104)	(95)	(85)	(101)	(127)
Distilled water control		1.797	0.340	218	95.0 77.48**	90.0 71.79**	336
		(103)	(102)	(100)	(98)	(98)	(105)
Untreated control		1.739	0.334	218	97.0 80.92**	92.0 73.99**	318
		(100)	(100)	(100)	(100)	(100)	(100)
SEM± CD at 5%		0.049 ±0.142	NS	1.865 ±5.4	1.54 ±4.46	1.119 ±3.24	17.04 ±49.37

Treatment	Dose (ng/ml)	Cocoon Parameters					
		Male			Female		
		Cocoon weight (g)	Cocoon shell weight (g)	Cocoon shell ratio (%)	Cocoon weight (g)	Cocoon shell weight (g)	Cocoon shell ratio (%)
3 IBA	100	0.868	0.121	13.96 21.92**	1.145	0.128	11.16 19.48**
		(106)	(112)	(105)	(105)	(103)	(98)
3 IBA	200	0.865	0.121	13.98 21.93**	1.160	0.126	10.90 19.07**
		(106)	(112)	(105)	(107)	(101)	(95)
3 IBA	300	0.825	0.110	13.27 21.34**	1.080	0.124	11.47 19.77**
		(101)	(101)	(100)	(100)	(100)	(100)
Distilled water control		0.853	0.115	13.58 21.57**	1.131	0.123	10.87 19.21**
		(105)	(106)	(102)	(104)	(99)	(95)
Untreated control		0.812	0.108	13.31 21.44**	1.082	0.124	11.42 19.73**
		(100)	(100)	(100)	(100)	(100)	(100)
SEM± CD at 5%		NS	NS	NS	NS	NS	NS

*Significant at 5%; **Angular transformed figures, NS=Non significant, Percent increase/decrease over that of untreated control in paranthesis.

instar larvae. The results obtained in the present study supports the view of Neumann(1982) in which feeding the grasshopper, *A. ellotti* with plant hormones in low concentrations increased the fecundity. Guerra(1970) also reported that dietary supplimentation of 3IBA decreased the fecundity in *H. zea*. The results obtained in the present study do not support the view of Guerra (1970). There was no significant difference in the parameters of distilled water-treated and-untreated controls,

These observations suggest that repeated applications of 100ng of 3IBA at 36h to III, IV and V instar larvae have better effects on improving the cocoon parameters of silkworm, *B. mori*.

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