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Effect of leaf quality of mulberry in induction of bacterial flacherie of mulberry silkworm, *Bombyx mori* L.

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Nutrition of silkworm, *Bombyx mori* L. plays an important role on growth, development and overall performance of cocoon (Benchamin and Jolly, 1986).Krishnaswami *et al.* (1973) observed that the growth and development of silkworm larvae and economic characters of cocoon get affected by feeding leaves of low quality. They also suggested that the health and development of silkworm is closely related to quality and also quantity of leaf fed. According to Aruga (1994) the production of cocoons is highly influenced by the quality mulberry leaf and one of the major reasons for the outbreak of flacherie disease is the poor quality mulberry leaf. It was also reported that the improvement of mulberry leaves could be made by micronutrients (Horie *et al.*, 1967) and zinc, iron, magnesium and boron (Lokanath and Shivashanker, 1986).

The present study was carried out to study the effect of two bacterial strains when combined with a stress factor, *viz,* the iron deficient leaf. Normally stress conditions such as feeding of poor quality mulberry leaves and fluctuations in temperature conditions predispose the larva to pathogen. Hence in the present study, an attempt was made to assess the impact of feeding iron deficient leaves infected with flacherie disease caused by *Bacillus thuringiensis.* The iron deficient leaves were fed to healthy larvae and also to the larvae already inoculated with the pathogen, *B. thuringiensis.* The experiment was conducted in a completely randomized design. Each treatment was replicated four times with 30 larvae per replication. The *B. thuringiensis* inoculum @ 10^7 spores/ml and 2.5 x 10^9 spores/ ml were administered through leaf feeding once to third instar larvae of cross breed, PM x NB_4D_2 immediately after moulting. Two different types of Kanva-2 leaves *viz.*, normal and iron deficient leaf and two different strains *viz.*,virulent strain (OI-CHI-01) and an avirulent strain (OO-CBE-06) were used for the study. The treatment consisted of Normal Kanva-2 leaf + virulent strain (01 - CHI - 01), Normal Kanva-2 leaf + avirulent strain (00 - CBE - 06), Iron deficient leaf + virulent strain (01 - CHI - 01), Iron deficient leaf + avirulent strain (00 - CBE - 06), Normal leaf alone and Iron deficient leaf alone.

Observations were made on larval mortality (until cocoon formation) and on larval and cocoon parameters by observing ten numbers per replication. The total nitrogen content (Piper, 1966), total phosphorus, potassium, calcium and magnesium content of leaf were also estimated (Jackson, 1973). Total chlorophyll, chlorophyll a and chlorophyll b were also estimated by spectrophotometry (Sadasivam and Manickam, 1996).

Mortality and economic parameters

Iron deficient leaf combined with the virulent strain (OI-CHI-01) at a dose of 10^7 spores/ ml and 2.5X10^9 spores/ml produced the highest mortality of 81.83 per cent and 99.14 percent respectively followed by virulent strain combined with normal leaf (64.58% and 95.63 %). The result obtained is in conformity with results of Manimegalai *et al.* (2000) who reported that feeding of iron deficient leaf resulted in 59.26 and 41.50 per cent mortality by leaf and shoot method of rearing respectively. Feeding of normal leaf recorded the highest larval weight (3.57 g), cocoon weight (1.55 g), shell weight (0.27 g), shell ratio (17.52%) and silk filament length (746 m) which was significantly better than other treatments. The

Table 1. Effect of leaf quality and different isolates of bacteria (10^7 spores/ml) on the mortality of third instar larvae of *B. mori* and economic characters

Treatments	Mortality (%)	Corrected mortality (%)	Larval weight (g)	Cocoon weight(g)	Shell weight(g)	Shell ratio (%)	Silk filament length (m)
Normal leaf + virulent strain	65.84 (54.26)^{b}	64.58 (53.51)^{b}	2.74^{cd}	1.31^{bc}	0.21^{cd}	16.03^{cd}	625^{C}
Normal leaf + avirulent strain	8.32 (16.69)^{6}	5.09 (11.10)^{6}	3.00^{b}	1.36^{b}	0.23^{b}	16.55^{bc}	704^{b}
Iron deficient leaf + virulent strain	82.50^{a} (65.37)^{a}	81.83^{a} (64.89)^{a}	2.21^{d}	1.28^{C}	0.20^{d}	15.40^{d}	576^{d}
Iron deficient leaf + avirulent strain	54.17 (47.39)^{c}	52.59 (46.49)^{c}	2.14^{d}	1.32^{bc}	0.22^{bc}	16.23^{bc}	648^{C}
Iron deficient leaf alone	40.00 (39.22)^{d}	37.87 (37.96)^{d}	2.40^{C}	1.32^{bc}	0.22^{bc}	16.89^{ab}	692^{b}
Normal leaf alone	3.33 (8.99)^{f}	0.00 (0.00)^{e}	3.57^{a}	1.55^{a}	0.27^{a}	17.52^{a}	746^{a}

Figures in parantheses are arc sine transformed values

In a column, means followed by a common small letter (s) are not significantly different by DMRT ($P = 0.05$)

economic parameters were found to be lower in the iron deficient leaf combined with virulent strain treatment (Table 1). The treatments registered lesser larval and cocoon parameters compared to untreated control and necessitated the need for good quality mulberry leaves for realising higher cocoon yield. The present finding corroborates with works of Banuprakash (2001) who observed a reduction in cocoon weight, pupal weight, shell weight and shell ratio irrespective of sub species of *B. thuringiensis* administered. Feeding of normal leaf recorded the highest economic characters compared to other treatments (Table 2). Iron deficient leaf alone caused 37.87 and 41.26 per cent mortality at two different doses of *Bacillus thuringiensis.*

Nutrient and chlorophyll content in chlorotic leaves of mulberry

The different nutrients in percentage *viz.,* nitrogen, phosphorus, potassium and crude protein estimated in iron deficient leaf were 2.99, 0.011, 1.47 and 18.69 respectively which were significantly lesser compared to normal leaf (Table 3). The quantity of iron in iron deficient leaf was 228 ppm as against 309 ppm in normal leaf. No significant difference in calcium and magnesium was recorded between iron deficient and normal leaf. The iron deficient leaf recorded 0.16, 0.06 and 0.21 mg/g of chlorophyll a, chlorophyll b, and total chlorophyll as against 1.84, 0.79 and 2.62 mg per g in normal leaf respectively.(Table 3).The nitrogen content (2.99%), phosphorus (0.011%) and potassium (1.47%) were lower in iron deficient leaf compared to 4.50, 0.032 and 2.25 per cent respectively in normal leaf. The decrease in protein, nitrogen and phosphorus in iron deficient leaf were also demonstrated by Subbaswamy *et al.* (2001) in a survey conducted in sericultural tracts of Karnataka. The leaf pigments, chlorophyll a, b and total chlorophyll were also found to be significantly lesser in iron deficient leaf compared to normal leaf. The present results are in conformity with findings of Singhvi *et al.* (2002) who reported lesser quantity of chlorophyll in chlorotic mulberry leaves.

Table 2. Effect of leaf quality and different isolates of bacteria (2.5×10^9 spores/ml) on the mortality of third instar larvae of *B. mori* and economic characters

Treatments	Mortality (%)	Corrected mortality (%)	Larval weight (g)	Cocoon weight(g)	Shell weight(g)	Shell ratio (%)	Silk filament length (m)
Normal leaf + virulent strain	95.83 (79.89)^b	95.63 (79.64)^a	**	**	**	**	**
Normal leaf + avirulent strain	8.34 (16.70)^e	5.09 (11.10)^d	3.23^b	1.35^b	0.23^b	17.07^a	698^b
Iron deficient leaf + virulent strain	99.17 (87.37)^a	99.14 (87.33)^a	**	**	**	**	**
Iron deficient leaf + avirulent strain	76.67 (61.26)^c	75.97 (60.76)^b	2.11^d	1.28^C	0.21^d	16.57^b	625^C
Iron deficient leaf alone	43.34 (41.15)^d	41.26 (39.91)^c	2.39^C	1.33^b	0.22^C	16.58^b	679^b
Normal leaf alone	3.33 (9.00)^f	0.00 (0.00)^e	3.59^a	1.53^a	0.27^a	17.35^a	753^a

** Observations could not be recorded.

In a column, means followed by a common letter are not significantly different by DMRT ($P=0.05$)

References

Aruga, H. (1994). Diseases of silkworms. In: *Principles of Sericulture* (Translated from Japanese). Oxford and IBH Publishing Company Ltd, New Delhi, Bombay, Calcutta, pp. 207-215.

Banuprakash, K.G. (2001). Epizootiology of flacherie caused by *Bacillus thuringiensis* Berliner and relative toxicity of its subspecies to silkworm, *Bombyx mori L. Ph.D. Thesis*, University of Agricultural Sciences, Bangalore. 188 p.

Benchamin, K.V. and Jolly. M.S, (1986). Principles of silkworm rearing. In: *Proc. of seminar on "Prospects and Problems in Sericulture"* S. Mahalingam (ed.) Publishers Madras, pp. 63-108.

Horie, Y., Watanabe., K and Ito. T.(1967). Nutrition of the silkworm *(Bombyx mori* L.). Quantitative requirement of potassium, phosphorus, magnesium and zinc. *Bull. Seric. Expr. Sts.*, **22:** 181-193.

Jackson, M.L. (1973). Soil chemical analysis. Prentice Hall of India Pvt Ltd, New Delhi.

Krishnaswami, S., Narasimhanna, M.N., Suryanarayana, S.K. and Kumaraj. S. (1973). Sericultural manual 2, Silkworm Rearing, FAO Agricultural Services Bulletin, Rome. 131 p.

Lokanath, R. and Shivashankar, K. (1986). Effect of foliar application of micronutrients and magnesium on the growth, yield and quality of mulberry *(Morus alba* L.). *Indian J. Seri.*, **25:** 1-5.