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EFFECTS OF THE MAGNETIC FIELD ON THE DNA IN THE HAEMOLYMPH OF SILKWORM BOMBYX MORI L.

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Abstract : The effect of the magnetic field on the DNA in the haemolymph of *Bombyx mori* L. was investigated. The gain in DNA was obtained in the experimental group over the control group. The gain was more prominent after the exposure of the larvae to the magnetic field of 3500 G. Results were more pronounced in pure races than hybrids.

***IndexTerms - Bombyx mori* L., Magnetization, Haemolymph, DNA**

I. Introduction

In a number of countries, sericulture has become one of the major Argo based industry. By introducing efficient and ecofriendly techniques efforts have been made to improve the quantity of quality silk. Exposure of biological systems to magnetic field induces behavioural (Chougale and More, 1992), morphological (Pittman and Anstey, 1967), physiological and biochemical (Conely, 1966; Chougale, 1992; Chougale et al., 1993; Chougale et al., 1996) changes. The magnetic field has influenced the silk gland proteins and midgut protease (Chougale et al., 1995) and glycogen contents of the fat body of silkworm (Prasad and Upadhyay, 2014). The present paper analyses the influence of the magnetic field on the DNA contents of haemolymph in different strains of *Bombyx mori* L.

II. Materials and Methods

Quality disease-free layings (DFLs) of pure 'PM' and hybrid races {[CSR×Kolar] and [(CSR2×CSR27)×(CSR6×CSR26)]} of silkworm *Bombyx mori* L. were obtained from National Silkworm Seed Organization (NSSO), Mysore. The eggs were incubated at 25℃ and relative humidity of 80%-85% was maintained and larvae hatched from them were supplied with V1 variety of mulberry leaves and reared separately under constant temperature and relative humidity. The rearing technique of Krishnaswami et al., 1973 was followed. The larvae from each DFL were divided into control and experimental batches. Experimental batch larvae were further divided into four groups. They were exposed to the magnetic field of 1000 G, 2000 G, 3500 G and 4000 G separately during first three days of fifth instar. They were magnetized for 20 minutes daily.

Five larvae of each group were collected randomly on the fifth day of fifth instar. By puncturing the abdominal legs haemolymph was collected in eppendorf tubes. The chilled distilled water was added in eppendorf tubes and they were centrifuged at 4000 rpm. Supernatants were used to determine DNA. For the purpose Burton Diphenylamine method (Burton K, 1956) was followed.

III. Results

Alterations in the DNA content of haemolymph due to exposure of silkworm *Bombyx mori* L. to various magnetic field strengths are given in table 1. Larvae exposed to the magnetic field showed a gain in DNA contents of haemolymph of all experimental groups except one group (magnetization of double hybrid larvae at 4000 G) (table 1, fig 1). The gain obtained was different for all experimental groups and all strains studied. However, the trend in gain was similar in all strains studied.

Exposure of larvae to the magnetic field of 1000 G to 3500 G showed a gradual increase in DNA contents (table 1, fig 1). 44.14%, 26.72% and 37.05% gain in DNA contents were seen respectively in the PM, hybrid and double hybrid strain due to magnetization of the larvae at 1000 G. Magnetization of PM, hybrid and double hybrid larvae at 3500 G resulted in 102.29%, 107.74% and 40.40% gain respectively over that of their control group. Magnetization of PM and hybrid larvae at a field strength of 4000 G showed a gain in DNA contents. However, this was less as compared to that obtained for magnetization at the low magnetic field (1000 G -3500 G) fig 1, table1.

Table 1: DNA content (µg/g) in haemolymph of silkworm *Bombyx mori* L. after magnetization

Sr. No.	Strains → / Larval Groups ↓	PM	Hybrid	Double Hybrid
1	Control	24.42	42.36	59.62
2	1000 G. M.	35.2 144.14% (+44.14)	53.68 126.72% (+26.72)	72.62 121.80% (+21.80)
3	2000 G. M.	46.9 192.05% (+92.05)	61.66 145.56% (+45.56)	74.77 125.41% (+25.41)
4	3500 G. M.	49.4 202.29% (+102.29)	88.00 207.74% (+107.74)	83.71 140.40% (+40.40)
5	4000 G. M.	33.3 136.36% (+36.36)	56.20 132.79% (+32.79)	57.20 95.94% (-04.59)
6	T test	***	***	**

Figures in Parenthesis indicate percent increase or decrease. G: Gauss M: Magnetic field
significant P≤0.01 levels; * significant P≤0.001 levels

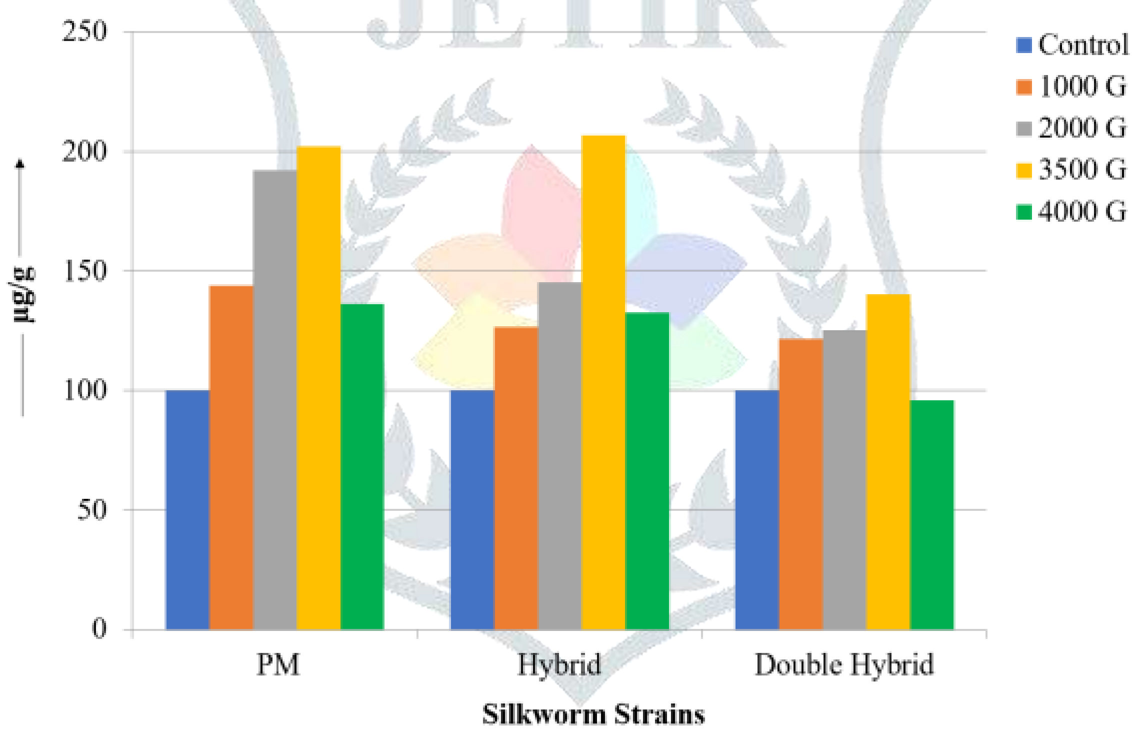

Fig.1 DNA content in haemolymph of *Bombyx mori* L. after magnetization

IV. Discussion

Physiological and biochemical parameters play an important role in the growth of insects (Ring, 1973). Growth, development and silk production in silkworm is controlled by genetic, hormonal and nutritional factors (Kerkut and Gilbert, 1985). The growth and development of silkworm have a direct relationship with silk production and is influenced by genetic, hormonal and nutritional factors (Kerkut and Gilbert, 1985). Eid et al., 1989 have reported the increase in RNA contents in the silkworm, *Philosamia ricini* after feeding them an excess of amino acids.

Ring (1973) reports that the RNA indicates an index of the capacity of protein synthesis and DNA contents help in the estimation of cell number. The protein synthesis of each cell is reflected by the RNA/DNA ratio (Lang et al., 1965). The silk gland of silkworm shows polyploidy. Its DNA synthesis increase with increasing larval instar and is terminated during the late last instar (Suzuki, 1977). This increase in DNA content is accompanied by gain in RNA and protein content (Islam and Roy, 1983). Peak levels of RNA and protein block DNA synthesis (Islam and Roy, 1983). Enhanced feeding activity (Chougale et al., 1992) and gain in nucleic acids of silk gland have been reported after magnetization of silkworm (Chougale and More, 1995; Chougale et al., 1996). A similar result has been obtained in the present investigation.

Biological systems are affected directly or indirectly after their magnetization (Patnev and Mankova, 1986). Applications of low magnetic field strengths are stimulatory or have no effect and higher field strengths are inhibitory (Mulay and Mulay, 1964). There may be change in the pattern or rate of accumulation and translocation of magnetically active microelements (Mericle et al., 1964). According to Young (1969), the magnetic field effects are reversible in nature. Chougale and More 1992, Chougale et al., 1995 reported that magnetization of fifth instar silkworm shows up to 32% increase in the silk production and also increase in RNA content of silk gland. Additional increase in RNA content results in additional silk synthesis and its production indicated the stimulatory effects of magnetic field. For the present investigation results obtained for the DNA content in haemolymph of magnetized larvae are of similar lines and efforts are being made how exactly magnetic field influences the silkworm.

V. Conclusion

Magnetization of silkworm, *Bombyx mori* L. shows increase in DNA content in haemolymph. Gain is optimum at 3500 G and trend is similar for all strains studied.

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