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Effect of mulberry nutrition on protein and free amino acid levels of haemolymph of selected races of the silkworm, *Bombyx mori* L. under temperate climates of Kashmir

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Changes in the levels of protein and free amino acids in the haemolymph of three selected silkworm breeds *viz*., SKAU-R-1, SH-6 and NB4D2, fed with selected mulberry varieties like Ichinose (control), Goshoerami (uniformly the best), and Kokuso-20 (least productive) were investigated in 4th moult, and 5th instar larval development during spring and summer seasons. The protein levels in haemolymph were lower at moult in all the three races but the levels showed a sharp increase upon resumption of feeding. The mean levels of protein irrespective of seasons were relatively higher in larvae of SKAU-R-1 (44.97 mg/ml) followed by NB4D2 (44.35 mg/ml) and SH6 (42.48 mg/ml). Haemolymph free amino acid levels decreased during 5th instar from the level observed at 4th moult. The mean free amino acid level for the entire 5th instar larval stage in both seasons was relatively higher in NB4D2 (4.55 mg/ml) followed by SKAU-R-1 (4.25 mg/ml) and SH6 (4.17 mg/ml). Free amino acid levels dropped through the 5th instar larval development in all the three races. The changes in the haemolymph protein and free amino acid levels were observed from different base levels in the larvae feeding on different mulberry varieties. Racial differences in the haemolymph protein and free amino acid contents were observed during both seasons in relation to mulberry nutrition being higher in larvae feeding on the foliage of Goshoerami than Ichinose and Kokuso-20.

Key words : Mulberry, *Bombyx mori,* Haemolymph, Protein, Free amino acid

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INTRODUCTION

Silkworm (*Bombyx mori* L.) is a monophagous insect. The silkworm, *Bombyx mori* feeds voraciously on mulberry foliage and increases in mass over five thousand times in about four weeks of larval life. Normal silk production and weight of the matured larvae during 5th instar are directly related to protein content of the leaves. Growth rates and maximal larval weights are significantly different in silkworm races like SK1, SH6 and NB4D2 (Sabhat *et al.,* 2011) and accordingly their protein requirements vary. Miyashita (1986) reported that the productivity of the silkworm is controlled by mulberry leaf (38.20%), climate (37.00%), silkworm rearing techniques (9.30%), silkworm race (4.20%), silkworm egg (3.10%) and other factors (8.20%). The two factors that affect the successful cocoon crop production most are, therefore, environment and leaf quality. The growth rates also vary at different stages of larval development and largely depend on the leaf ingestion level. About 80 per cent of leaf is ingested in 5th instar which increases by each day in the instar. Silk protein biosynthesis begins at the end of larval growth phase and lasts a couple of days. A major portion (about 70%) of the silk protein produced by the silkworm is directly derived from the proteins of the mulberry leaves (Fukuda, 1960) and therefore, the utility of a mulberry protein depends on its solubility and leaf moisture content. Insects have very high free amino acid content in the haemolymph which is considered as a biochemical characteristic of insects (Florkin, 1959). Silkworms obtain 72-