ABSTRACT

Sericulture has been a part of culture and tradition of the inhabitant of Assam, and it plays a prominent role in rural livelihood and economy of the state. The climatic factors and biogeography of Assam favors the rearing and production of all four types of silk like Eri, Muga, Tassar and Mulberry. Kokrajhar district is one of the major silks producing area where sericulture is almost a household affair. The rearing of eri silkworm is closely associated with the tradition and culture of the Bodo society and it occupies a distinct place in the socio-economic status of the local inhabitants of Kokrajhar district. Rearing of eri silkworm is practiced mainly by the tribal inhabitants of the district.

Sericulture being one of the oldest agro-industry provides employment and helps in generating income to the rural and marginal poor inhabitants of the society. Ericulture is predominantly popular mostly because it can be reared indoor unlike the other silkworms, making it suitable for the women to carry out rearing along with the household chores. The art of rearing silkworms, reeling, and weaving silk fabrics is associated to the tradition of the Bodos. The eri silkworm not only produces silk but also provides nutrition. The pupa of eri silkworm is considered a delicacy by the tribals of Kokrajhar, particularly Bodos.

Host plants play a crucial role in providing nutrition for growth and development of the silkworm. The eri silkworm feeds on a variety of host plants however, the farmers mostly prefer the primary host plant, *Ricinus communis* (castor). The non-availability, lack of good quality leaves due to sensitive nature of the castor plant makes it difficult for the farmers to sustain ericulture throughout the year for maximum silk production. The cost of planting castor is also an expensive affair. Therefore, evaluation and utilization of alternate host plants during the scarcity of primary host plant, *R. communis* is necessary to carry out ericulture continuously throughout the year and increase the silk production.

The present study was taken up to study the suitability of available secondary host plants in rearing of *S. ricini* as compared to the primary host plants *Ricinus communis.* In the present study, rearing of *S. ricini* was done on four different host plants namely, *Manihot esculenta* (Sample T), *Gmelina arborea* (Sample G), *Heteropanax fragrans* (Sample K) and *Carica papaya* (Sample P) along with the control host plant, *R. communis* (Sample C) during four different seasons viz., Season 1 (February-April), Season 2 (May-July), Season 3 (August-October) and Season 4 (November-January). The biochemical constituents of the selected host plants were evaluated and the growth parameters of the eri silkworm were studied based on the types of host plants used. The effect of the host plants used were also studied on the biochemical contents, nutritional contents, and immunological response of the silkworms.

The effects of host plants were studied on the total and differential haemocyte count using a hemocytometer. The total haemocyte count was found to be highest in the haemolymph of *S. ricini* reared using *R. communis* leaves (Sample C) at 2280±32.66 cells/ mm^3 while the lowest number of haemocyte was found in the haemolymph of *S. ricini* reared using *C. papaya* leaves (Sample P) at 893.33±48.89 cells/ mm^3. Differential haemocyte count showed that Sample C, Sample T and Sample G, showed highest number of Plasmatocytes (PL), followed by Granulocytes (GR), Spherulocytes (SP), Prohemocytes (PR), and least number of Oenocytes (OE). The samples reared using *H. fragrans* (Sample K) and *C. papaya* (Sample P) contained higher number of Granulocyte cells as compared to the other types of haemocytic cells. The variation in the differential haemocyte count may be due to the influence of the types of host plants used for rearing.

The effects of host plants were also studied on the growth and economic parameters of the silkworms. The effects of host plants were seen on the larval and pupal duration of the silkworms. The duration of the larva and pupa were found to be affected by the difference in the host plants used. The silkworms in Sample C showed shorter larval duration (21.25±0.83 days) and pupal duration (11.08±0.76 days) during Season 2 while the silkworms in Sample P showed longer larval duration (41.75±1.24

days) and pupal duration (17.91±0.76 days). Seasonal variations were also found to affect the larval and pupal duration as it was found to be shorter during warmer seasons and longer during winters. Similarly, the difference in the fecundity, hatchability, effective rate of rearing, emergence rate and survival rate were also studied based on the different host plants used. The silkworms in Sample C showed higher fecundity (471±8.81 nos.), hatchability (94.72±4.18 %), effective rate of rearing (85.52±6.06 %), emergence rate (91.75±4.14 %) and survival rate (90.74±4.73 %) however, the silkworms in Sample T and Sample K were also comparable with that of Sample C. Sample P showed lowest fecundity (317.08±5.54 nos.), hatchability (80.28±5.52), effective rate of rearing (62.23±6.36 %), emergence rate (76.57±6.15 %) and survival rate (71.72±7.92 %) during Season 4. The cocoon parameters like cocoon weight, shell weight and shell ratio were also found to be influenced by the host plants used for rearing.

The biochemical content of *S. ricini* like protein, carbohydrate, mineral was also studied. The estimation of proximate composition clearly demonstrated the nutritional significance of eri silkworm pupae as a valuable protein source and fat source with a notable amount of dietary fibre content. The proximate analysis of the larval extract of *S. ricini* and the leaf extract of host plants used for rearing *S. ricini* provides valuable insights into the nutritional content of both the larvae and its dietary source. The nutritional profile of the silkworm varied significantly depending upon the host plants that were used for rearing. The Sample C exhibited higher level of crude protein (60.78 g/100g) and fat content (14.14 g/100g) , fibre was higher in Sample T (5.56 g/100g) as compared to those fed on other host plants. Sample P showed lower level of crude protein (56.68 g/100g), fibre (3.31 g/100g) and fat content was lower in Sample T (11.02 g/100g) which indicated difference in the nutritional quality of the larvae based on their diet. The proximate analysis of the leaf extract of the host plant further elucidated the relationship between the nutritional contents of the larvae and its dietary sources.

The fatty acid profiling of the *S. ricini* reared using different host plants were analyzed using gas chromatography-mass spectrometry (GCMS). It was found that the

larvae of *S. ricini* contained a variety of compounds which are essential for the nutrition and physiological functioning of the silkworms. The quality of protein was contingent upon the arrangement of amino acids. The amino acid derivatives of larvae of *S. ricini* reared using different host plants were analyzed using high-performance liquid chromatography (HPLC) and it was observed that the eri silkworm contains almost all the 17 known amino acids. These amino acids were discovered to be of higher quality compared to certain animal and vegetable proteins, such as chicken eggs and sunflower. Presence of these amino acids in the larvae of *S. ricini* is also beneficial for the human as the pupa is consumed by the local inhabitants of Kokrajhar district.

Antioxidants are an exclusive group of compounds that could impede oxidation and significantly contribute to limiting the possibility of various disease outbreaks. The antioxidant capacity of eri silkworm larvae was evaluated using several conventional antioxidant assays, including DPPH, ABTS, and reducing power. The results demonstrated that the methanolic extract of eri silkworm larvae exhibited a strong ability to eliminate free radicals. The Ferric Reducing Antioxidant Power Assay (FRAP) revealed that Sample C exhibited highest antioxidant activity while the Sample P showed lower antioxidant activity. Similarly, the DPPH scavenging activity assay showed concentration dependent inhibition of free radicals, with Sample C having lowest IC_{50} value, indicating superior antioxidant potential followed by Sample K. The Sample P showed lower antioxidant potential. Additionally, the ABTS assay further corroborated these findings, which indicated the variability in antioxidant activity among the silkworms reared on different host plants.

The study on the GST and Catalase enzyme activity was carried out and it was found that the highest GST enzyme activity was observed in Sample P while the lowest was observed on Sample C. Conversely, the lowest catalase enzyme activity was observed in Sample P, with the highest activity on Sample C. These variations in the enzymes activity was likely to be attributed by difference in nutritional and phytochemical contents of the host plants which might potentially induced stress in the physiology of the silkworm.

The present study indicated ericulture as a major cottage industry of the inhabitants of Kokrajhar district which is mostly carried out by the farmers as part-time occupation which helps in improving the livelihood and economy of the society. It was also found that the host plants along with certain environmental factors like temperature and humidity had a major impact on the growth, biochemistry as well as on the immunological responses of the silkworm, *S. ricini*. The unavailability of quality host plants was one of the major drawbacks for sustainable ericulture and overall silk production. The present study indicated that the use of available secondary host plants during the scarcity of primary host plant could help the farmers to carry out ericulture throughout the year and increase its productivity in producing silk and its value-added products. The performance of the *S. ricini* reared on *Manihot esculenta* (Sample T), *Gmelina arborea* (Sample G), *Heteropanax fragrans* (Sample K) and *Carica papaya* (Sample P) was found to be comparable to the economic parameters of the silkworms rearing using the host plant, *R. communis* (Control).