Eri pupa: a delectable dish of North East India

North East India is one of the mega biodiversity centres of the world with flourishing green forests and suitable climatic conditions harbouring varied flora and fauna, including silk-producing insects. Of the five commercially exploited silk varieties, four are produced in the region, including eri silk. The Brahmaputra valley in Assam and its adjoining foothills are believed to be the original home of the eri silkworm *Samia ricini* (Donovan). *S. ricini* silkworms are utilized for the production of silk with unique thermal properties. Eri culture is mostly confined to the Brahmaputra valley in the tribal-inhabited districts. It is also practised in few districts of the neighbouring states, mainly Meghalaya, Nagaland, Manipur, Mizoram and Arunachal Pradesh. Presently, eri culture is spreading to different non-traditional states like Andhra Pradesh, Tamil Nadu, Karnataka, Gujarat, Jharkhand and Chhattishgarh. Eri culture has been in practice in NE India since time immemorial and has a close link with the tradition and socio-economic life of the people. Eri silk is known as 'poor man's' silk, as it requires minimum infrastructure for production and eri culture is practised by the poor section of the society. Eri yarn is used for making excellent winter garments and its pupae supplement the requirement of protein among the rural poor. The name 'eri' is derived from the Assamese word 'era', meaning 'castor', the main food plant of eri silkworm. The tribals as well as general eri farmers of NE India consume eri pupa. People of the Ahom community consume eri pupa in the mature stage. Most of the tribal communities of NE India, viz. Garo, Naga, Bodo, Missing, Rabha, Kachari, etc. prefer pre-pupal stage for consumption.

Judicial utilization of silkworm as a source of food is practised in many countries of the world[1]. For the tribals in NE India, the eri chrysalid (pupa) is a delicacy and the cocoon is more or less a by-product[2]. Pre-pupa is removed after the cocoon has been completely formed. The pupae of *Bombyx mori* (family Bombycidae) are used as food and animal feed in various Asian countries[3]. The edible pupae are the by-product of commercial silk production, and obviously any insect that can produce two or more useful products simultaneously increases its economic and environmental efficiency. In addition to the mulberry silk moth, there are more than a dozen species of 'wild' silk producers (Lepidoptera) of commercial interest, the pupae of which are also used as food or animal feed. Three important species, all Saturniidae (giant silk moth), are found in Asia. *Antheraea pernyi* feeds on oak leaves and produces tasar silk. Thousands of acres of oak are under cultivation in China today for tussah (tasar silk) production, and the pupae are considered a delicacy. *Antheraea assamensis* produces muga silk, and the Government of India is actively promoting the development of muga culture with research aimed at producing varieties that are better suited for indoor rearing and yielding larger cocoons. Experimental study has shown the pupae to be suitable as a high-protein substitute for fish meal in chick diets. The situation is somewhat reversed in the case of the eri silk moth, *S. ricini*, which has been domesticated for centuries in India, China and Japan. For the tribal people in NE India, the eri pupa is considered a delicacy, whereas the cocoon is more or less a by-product. The species is an ideal example of sustainable agriculture, which produces silk and a pupa that is a high-protein food or animal feed, and the caterpillar and other rearing residues can be used for fish-pond culture. Silkworm pupae have been used in Chinese traditional medicines since ancient times[4]. Pharmacological studies have shown that silkworm pupae increase immunity, protect the liver and prevent cancer. Proximate analysis of pupa has shown that it contains 55–60% protein, 25–30% lipid, 4.96% fibre, and other substances, e.g. hormones, trace elements and vitamins, thus indicating that it could be a good protein source for various purposes[4,5]. Analysis of pupa *Philosoma ricini* (eri silk) showed high moisture content (74.66%), protein (18.44%), lipid (4.24%) and ash (1.58%). Comparison with *B. mori* and *Attacus ricini* pupae showed similarity, as the main components were also moisture (65.13% and 70.14% respectively) with protein and ash contents of 11.99% and 0.79% respectively, for *B. mori* and 15.97% and 1.36%, respectively, for *A. ricini*[6]. However, the lipid content (20.10%) in *B. mori* (domestic strain), was much higher than that in *P. ricini* (4.24%) and *A. ricini* (11.09%) (wild strains). Though the protein content was not as high as that in eri silk cocoon (96.32%), it was rather high and could be applied as protein source for either cosmetics or food. The pupae can be sold as fertilizer, biogas[7], feed[5,8] and other agricultural purposes. Eight of the nearly 20 species of insects were found to be commonly used as food among the various tribes in Manipur[9]. The pupae of the Assam muga silkworm, *Antheraea* (=*Antharaca*) *assamensis* (Westwood) can be a high-protein substitute for fish-meal in chick diets[10].

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