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Functional Findings from Various Silkmoths and Their Utilization

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In the past decade, comparative studies have provided important findings on several wild and domesticated silkmoth. Although each findings has areas which are not yet resolved, the main advances in our knowledge concern: (1) cocoon filament characters and post–cocoon technology, (2) absorbance and transmissivity of ultraviolet by wild silks, (3) anti–bacterial function of natural silk materials, (4) thiamin is decomposed by anaphe entomophagy, and (5) the social *Anaphe* silkmoth.

1. Cocoon filament characters and post–cocoon technology: Since our reports in 1989 on fine–vacuolar structures of the cocoon filament and liguid silk in the silk gland of *Antheraea yamamai* (Akai et al., 1989), the fine structural characteristics of cocoon filament have been further researched together with post–cocoon technology. While no vacuolar filament has been identified in the domesticated *Bombyx mori,* despite much available information on the structure and fine structure of the silk and the filament, SEM showed that the filaments of *A. pernyi* and *A. mylitta* contained numerous fine vacuolar canals, as also true of *A. yamamai. Gonometa postica* and *Anaphe infracta* have no porus structure of the cocoon filament, in spite of being completely wild silkmoths. We compared various cross sections of cocoon filaments from the silk–spinning insects of 5 families and 15 species, as ahown in Table 1. The results clearly showed that all cocoon filaments from Saturniidae insects were porous, and all others from Bombycidae, Lasiocampidae, Thaumetopoeidae and Paychidae exhibited compact (non–porous) filaments.

2. Absorbance and transmissivity of ultraviolet by the wild silkmoths: Various lepidopteran insect species spin silk and make a thick cocoon shell to protect their molt and metamorphosis from environmental factors, including strong ultraviolet (UV) rays. These insects have also acquired several

biologically resistant features during their long evolutional history, for example, an anti–bacterial function (Akai, 1997) and a prospective effect of UV. We tested the UV absorption and transmission effects of a special silk paper manufactured with domesticated and wild silks, and found that the wild silk paper has offers a strong protective affect against UV.

3. Anti–bacterial function of natural silk materials: We recently became aware that some silk materials have functions, which inhibit fungal and bacterial proliferation on the surface of various foods. Simple tests were made on the antifungal function of certain silk materials using Japanese mochi (a pure rice cake with no other ingredients). These tests indicated that the silk materials apparently do have a property inhibiting bacterial proliferation.

4. Thiamin is decomposed by *anaphe* entomophagy: A fairly high activity of a relatively heat–resistant thia minase was detected and characterized from pupae of an African silkmoth *Anaphe* which had been the putative cause of a seasonal ataxia and impaired consciousness in Nigerians. The thiaminase in the buffer extracted of *Anaphe* pupae was type 1 (thiamin: base 2-methyl–4–aminopyrimidine methyl transferase EC 2. 5. 1. 2), and the optimal temperature and pH were 70 C and 8.0 – 8.5, respectively. Based on gel filtration chromatography, the molecules were estimated to be 200 kDa. Second substrates which could be utilized by the thiaminase were pyridoxine, amino acids, glutathione, taurine and 4–aminopyridine. Thiamin phosphate esters were inactive as substrates. This is the first repot describing an insect thiaminase. Our results indicate the necessity of thorough heat treatment for the detoxification of the African silkmoyj, making the worm a safe source of high–quality protein (Nishimune et al,. 2000).

5. Are they social silkmoth?: Mature *Anaphe* larvae collaborate to make a huge silk nest which is composed of a common silk shell and numerous individual cocoons. A special stimulating vapor released from the nest causes the skin to itch when touched by human hand. Following degumming of a cut nest, we no longer feel this sensation which means that the stimulating chemical is contained in sericin of the cocoon filaments. Each silk filament is flat in cross section and compact, without any fine porous structure.