A18

A Novel Function of *Bombyx Sex-lethal*, the Homologue of the Master Sex Determination Gene in *Drosophila*

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Sex determination in insects has many variations. For instance, in *Drosophila melanogaster*, the primary signal for somatic sex determination is the ratio of X chromosome to sets of autosomes (X:A). This signal is interpreted as ON and OFF regulation of the *Sex-lethal* (*Sxl*) gene in female and male, respectively. Functional SXL has two RNA binding domains and is produced only in females, where it regulates all aspects of somatic sex determination through the regulation of splicing and translation. Meanwhile, in the silkworm *Bombyx mori*, the sex chromosomes for males are ZZ, whereas for females are ZW. Female determining (*Fem*) locus on W chromosome determines female sex in *B. mori*. Although much progress has been made towards the unraveling of molecular mechanisms involved in sex determination in *D. melanogaster*, the same aspect remains obscure for other insects. Therefore, comparative analyses are essential to understand genetic regulatory pathways involved in sex determination among insects.

As an initial step to understand the molecular mechanisms of sex determination in silkworm, we cloned the *Bombyx Sex-lethal* (*BmSxl*) gene, which is a homologue of the master sex-determining gene in *Drosophila*. BmSXL has two isoforms (BmSXL-L and BmSXL-S), which differ in the length of N-terminus. Interestingly, *BmSxl* is sex-specifically regulated only in germline, unlike in *D. melanogaster* in which sex-specifically regulation takes place in both germline and somatic cells. Moreover, in germline sex determination of *Drosophila*, *Sxl* is not a master switch gene but indispensable for oogenesis. In contrast, *BmSxl* is mainly expressed during spermatogenesis. Surprisingly, BmSxl-L is expressed in cytoplasm of spermatocyte for nucleate eupyrene sperm, whereas BmSxl-S is expressed in nuclei of spermatocyte for anucleate apyrene sperm. The distinct expression pattern of each BmSxl isoform corresponds well to the developmental stage for the transition from eupyrene to apyrene spermatogenesis. Thus, it appears that *BmSxl* controls the eupyrene-apyrene sperm dimorphism, which represents an evolutionary novelty of lepidopteran insects. These results provide new insights into the functional roles of *Sxl*.