Regulatory Role of Homeotic Genes in Lepidopteran Proleg Development*

Shuichiro TOMITA

National Institute of Agrobiological Sciences, Ohwashi, Tsukuba, Ibaraki, 305–0851, Japan
E-mail: tomita@affrc.go.jp

The basic body plan of the insect consists of three tagmata namely head, thorax and abdomen. Each thoracic segment bares a pair of appendages and abdominal segments in adult insects lack such a feature quite often. Prolegs are appendages that develop in the larval abdomen of Lepidoptera, Mecoptera and Symphyta of Hymenoptera. The limited distribution of proleg-baring species raises the question whether prolegs are homologous structures or convergent traits.

To address this issue we tried to analyze the molecular mechanisms underlying the proleg development in a lepidopteran species, *Bombyx mori*. Prolegs of *Bombyx* are segmented and bare crochets at their tips. Their ventrolateral position is in line with the thoracic legs and *Dll* expression is detected at their tips during embryonic development where the expression domains of *wg* and *dpp* are overlapped. These observations suggest geometrical information in developing prolegs in *Bombyx* is carried by the same genetic network as *Drosophila* legs and prolegs of *Bombyx* are likely serially homologous to the thoracic legs.

The development of appendages in abdominal segments in insects is suppressed by the expression of the homeotic genes, *Ubx*, *abd-A* and *Abd-B* in this tagma, and permissive expression of *Dll* in proleg-baring segments that is achieved by the “clearance” of *abd-A* expression is thought to result in the development of lepidopteran prolegs (Warren et al., 1994). Strange enough, the *abd-A* null mutant strain of *Bombyx*, *E*Cs animals fail to develop any prolegs (Ueno et al.,) and this is phenocopied by knocking down *abd-A* expression by injecting dsRNA for *abd-A* into the embryo (Tomita and Kikuchi, 2009). Moreover, *Dll* expression remains to be detected in the proleg primordial region in *E*Cs embryos. Knocking-down *Dll* made no effects on proleg development while gnathal appendages and thoracic legs are greatly reduced. Abd-A protein was accumulated at the proleg primordial regions and this trend is conserved among the genetic mutants that develop extra prolegs. This strong expression of Abd-A is observed only in the sixth abdominal segment of the embryo of a Geometridae species (*Milionia basalis*) which bares prolegs only on A6 segment. These results strongly suggest that during the development of abdominal prolegs of Lepidoptera *abd-A* plays promotive, rather than suppressive role and *Dll* expression is dispensable.

References


* Abstract of paper read at the 51st Annual Meeting of the Arthropodan Embryological Society of Japan, June 12–13, 2015 (Urabandai, Fukushima)