琉球大学学術リポジトリ

チョウの色模様形成に関する分子生理学的研究

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論 文 要 旨

Abstract

Title: **Molecular physiological studies on butterfly wing color pattern formation.**
(チョウの色模様形成に関する分子生理学的研究)

Immunohistochemistry and *in situ* hybridization studies of widely studied elements in butterfly wings, eyespots, showed a number of genes expressed in and around the presumptive focus during eyespot development. I here developed a functional assay system using the blue pansy butterfly *Junonia orithya* with baculovirus injection followed by anti-gp64 antibody injection. One of the candidate genes, *Distal-less* (*Dll*) has been implicated in eyespot formation. However, *Dll* expression is not sufficient for eyespot formation. Nevertheless, the baculovirus tool can be an invaluable tool to transfer, express, and functionally examine foreign genes in butterfly wings.

DNA polymorphism in *Dll* is linked with eyespot size variation in *Bicyclus anynana*. Using *J. orithya*, I compared *Dll* cDNA sequence variations on one side of the wing with color pattern on the other side from the identical individual. I found three different types of *Dll* variants in *J. orithya* wing however no clear relationship between *Dll* sequence and eyespot size variation was observed.

To establish a standard rearing method, we reported various artificial diets for *J. orithya* modified Insecta F-II, AD-FZMUV, AD-FZM, and AD-FBY, AD-FBY diets. The modified artificial diet Insecta F-II was used to feed pharmacological agent sodium tungstate to larvae of *J. orithya*. Low temperature treatment at larval stage provided immunity against cold shock or tungstate treatment. Therefore, we speculate that the cold-shock or tungstate induced color pattern pathway has a physiological relationship with the fall-morph-inducing pathway.

In addition, using three nymphalid butterflies, *J. orithya*, *Vanessa cardui*, and *Danaus chrysippus,* the mechanism of tissue size determination during morphogenesis was studied by counting and measuring all the scales on one of the compartments of the wing. I found that, the butterfly wing tissue size is determined primarily by the number of scale cells and then by the size change of scale cells before or during the period of row arrangement. The putative morphogen signal is likely a ploidy signal that determined cell size and scale size. It also likely determines scale coloration and shape.

In summary, based on the current knowledge, I proposed an integrated model for the wing color pattern formation and modification

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