

TOLL receptor gene family evolution in insects

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Abstract

Arthropoda can be found in almost every habitat on earth and many species are intimately related to human life, for instance, arthropod-borne diseases as malaria and yellow fever. Insects presence in most habitats and their wide variety of diet and behavior also means that they encounter various microorganisms many of which may be pathogenic, as result insects have evolved mechanisms for recognition and elimination pathogens, which include the signaling Toll pathway. Toll receptor is transmembrane protein essential for embryonic development and immunity, the induction of the Toll pathway by Gram-positive bacteria or fungi leads to the activation of cellular immunity as well as the systemic production of certain antimicrobial peptides. The Toll receptor is activated when the proteolytically cleaved ligand Spätzle binds to the receptor, eventually leading to the binding with other protein of pathway and activation of NF- κ B factors. To date, nine genes have been found in *Drosophila melanogaster* genome and similar numbers were found in other insects. Insects are ideal models for the study of the diversity of gene families and their evolutionary mechanisms because they have a well studied and well-known phylogeny and there are many examples of evolutionary specialization that have arisen in different bloodlines, such as hematophagy. Phylogenetic analyses using the Toll domain of each sequence retrieved from 40 insects genome was able to divide the Toll family into three well supported clades. The results revealed that insect Toll domain formed three major clusters. Here, we have shown that there is a variety of Toll copies in insect groups, with duplications and gene losses, our findings also show that the Toll9 does indeed appear to be closer to vertebrates than the other groups, and may indicate that it may be the most closely related group. In this study, Toll9 genes in the Hymenoptera order were not found, which may suggest that the gene was lost in the order. Insects immune evolution like the Toll pathway is important for an understanding of vector biology and behavior, helping in aspects of vector control and disease transmission.

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