Understanding how herbivorous insects specialize by studying the evolution of chemosensory perception

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Abstract

The perception of host plant volatiles by herbivorous insects is essential for their survival and reproduction, because they use their host plant both as a food resource and to lay their eggs. Therefore, this chemosensory perception is likely the target of selection during drastic environmental changes, such as host shift and host specialization, i.e. when insects change or reduce their diet breadth. These processes may ultimately lead to speciation of insect species. Studying the evolution of insect chemosensory perception will offer clues to understand why herbivorous insects are so diverse and why so many of them are specialized on a few host plant species. The screening of the chemosensory genes, i.e. the genes encoding odorant receptors, odorant binding proteins and other proteins involved in chemosensory genes, is now possible due to the recent advances of genomic approaches. We are identifying the chemosensory genes in the genome and antennal transcriptome of several beetle species in the genus *Blepharida*. This genus encompasses both generalist and specialized species and is engaged in an ancient coevolution with the plant genus *Bursera* in Mexico. By comparing the chemosensory genes among generalist versus specialized species, we can measure the evolutionary rate of chemosensory gene families, evidence the markers of host selection on the evolution of these genes, and ultimately propose mechanisms underlying the process of host shift or specialization, such as the loss or gain of new odorant receptors.

Keywords: chemosensory perception, genomics, transcriptomics, odorant receptor, insect specialization

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