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Repeated inversions within a *pannier* intron drive diversification of intraspecific colour patterns of ladybird beetles

Cover image:
Four basic color patterns of the ladybird beetle *Harmonia axyridis*
(Teruyuki Niimi, NIBB)

Repeated inversions within a *pannier* intron drive diversification of intraspecific colour patterns of ladybird beetles

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How genetic information is modified to generate phenotypic variation within a species is one of the central questions in evolutionary biology. Here we focus on the striking intraspecific diversity of >200 aposematic elytral (forewing) colour patterns of the multicoloured Asian ladybird beetle, *Harmonia axyridis*, which is regulated by a tightly linked genetic locus *h*. Our loss-of-function analyses, genetic association studies, de novo genome assemblies, and gene expression data reveal that the GATA transcription factor gene *pannier* is the major regulatory gene located at the *h* locus, and suggest that repeated inversions and cis-regulatory modifications at pannier led to the expansion of colour pattern variation in *H. axyridis*. Moreover, we show that the colour-patterning function of *pannier* is conserved in the seven-spotted ladybird beetle, *Coccinella septempunctata*, suggesting that *H. axyridis*' extraordinary intraspecific variation may have arisen from ancient modifications in conserved elytral colour-patterning mechanisms in ladybird beetles.

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