Viral domestication in Tachinid flies : a case of evolutionary convergence with parasitoid wasps ?

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Résumé

Throughout evolution, horizontal transfer, the exchange of genetic material amongst distant lineages, has played a pivotal role. Within the realm of eukaryotes, this phenomenon occurs in intimate relationships such as symbiotic associations. Notably, viruses often exchange genetic material with their hosts, occasionally leading to the domestication of these sequences when they confer adaptive benefits.

In parasitoid Hymenoptera, at least five cases of viral domestication have occurred. These wasps develop during their larval stages inside another insect. The acquired viral genes enable the production of chimeric virus-like particles formed by a combination of viral and wasp genes. These particles are then injected by female wasps during oviposition and the factors they contain act as inhibitors of the host's immune response against the egg. Whilst such viral domestication events occurred independently in several clades of Hymenoptera, involving different donor viruses, they strikingly converge in their function of helping the wasp bypass the host immune system, thus protecting its offspring.

However, beyond the Hymenoptera order – in which the association to viruses is well studied – there are other parasitoids such as Tachinid flies, the second predominant group of endoparasitoids with a remarkable host-range diversity. We are exploring the hypothesis that these insects, facing similar challenges of developing inside another living being, may also harbor traces of domesticated viruses within their genomes.

Our work aims to detect domesticated endogenous viral genes in Diptera genomes using homology search, co-phylogeny, and dN/dS approaches. We analyzed 77 genomes of diverse Diptera species comprising both Tachinid flies as parasitoids and non-parasitoids from the Schizophora group. We found an average of 46 endogenous viral elements per species, mostly related to double-stranded DNA viruses. Throughout my presentation, I will further develop the methods we used and discuss the relationship between endogenous viral elements and the endoparasitoid lifestyle.

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