8th International Germinivirus Symposium – 7-10 nov 2016

A pluricellular way of life for nanoviruses

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Nanoviruses are characterized by a genome composed of 6 to 8 circular ssDNA segments, each encapsidated individually in a distinct virus particle. A classical view in virology assumes that the viral replication cycle occurs within individual cells, where the whole viral genome information is replicated, and is then reiterated in successively infected cells during host invasion. In the context of multipartite viruses and of nanoviruses in particular, this view implies that at least one copy of each of the genome segments must repeatedly enter together in individual cells for successful infection and maintenance of the integral genome. Because one or more genome segments may be missing in numerous susceptible cells, thus aborting infection, the multipartite viral systems are believed to bear an enormous cost, which drastically increases with the number of segments constituting the viral genome. It has even been concluded that multipartite viruses with an elevated number of segments (typically member species of the family *Nanoviridae*) appear so costly that they should not have evolved and should thus not exist !

To address this paradox, we have experimentally tested the thus far undisputed assumption that the segments of a multipartite virus must be together within individual cells for the system to be functional. For this, we used the nanovirus *Faba bean necrotic stunt virus*, which genome is composed of 8 segments. Our results indicate that the various segments are not always together within individual cells and yet, that the system scattered over several distinct cells appears functional. This observation has important implications. First, it questions the cost that has always been attributed to multipartite viral systems, where gathering a copy of each segments in single cells was though to be mandatory. Second, it demonstrates that the replication cycle of a virus is not necessarily “cell-autonomous” and that the spatial unit of a virus replication cycle can be, in some cases, an ensemble of interconnected cells within which the various part of viral genetic information are obviously communicating.