O-3

A Novel Densovirus of the Prawn *Peneaus monodon* of a New Lineage within Subfamily Densovirinae Harbors a Unique Genome Organization, Transcription Pattern, and Possible Cellular Trafficking Routes

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The giant tiger prawn, Penaeus monodon, is a crustacean species widely reared for nutritional purposes. Currently, two distinct linages of densoviruses (family Parvoviridae, subfamily Densovirinae) are known to infect penaeid shrimps (genera Hepandensovirus and Penstyldensovirus). Recently, a novel densovirus was isolated and cloned, from Vietnamese *P. monodon* specimens. The complete genome length is 4374 nt, including ITRs of 416 nt with T-shaped hairpins. Out of at least three complete ORFs, the leftmost (1550 nt) displayed homology with densoviral NS proteins, with low identity (36%) and coverage (30%). None of the other ORFs possessed detectable parvovirus homologues. The rightmost ORF encodes the only 41-kDa-sized viral protein making up the capsid of approx. 21 nm. Its sequence includes the spacer domain of ADAM-TS metalloproteinases but lacks the phospholipase A2 (PLA2) domain conserved in most parvoviruses. Differential scanning fluorometry (DSF) revealed an unusual stability profile of decreasing thermostability from the most stable pH8.2 to entirely disintegrated capsids at pH 5.5, where most parvovirus capsids achieve peak stability. Transcription analysis revealed two promoters (p9 and p47) and one polyadenylation site. From the p9 transcripts, four NS proteins can be expressed, three differing only by their C-terminal regions. Both transcripts of p47 possibly express the capsid protein. Moreover, two additional proteins from ORF3 and by uniting the downstream end of the NS ORF with ORF2 might harbor enzymatic activity and a scaffolding role, respectively. Phylogenetic inference of parvoviral NS proteins confirmed this new virus, designated Penaeus monodon metallodensovirus, to be a distinct lineage, with the possible assignment to a new genus. The structural homology the capsid protein displayed with the salmonid infectious pancreatic necrosis virus (Birnaviridae) capsid protein suggests a recombination event to have occurred among aquatic ssDNA and dsRNA viruses. Currently structural studies are ongoing to further investigate these findings.