Cryo-electron microscopy structure of the Macrobrachium rosenbergii nodavirus capsid at 7 angstroms resolution

ABSTRACT

White tail disease in the giant freshwater prawn Macrobrachium rosenbergii causes significant economic losses in shrimp farms and hatcheries and poses a threat to food-security in many developing countries. Outbreaks of Macrobrachium rosenbergii nodavirus (MrNV), the causative agent of white tail disease (WTD) are associated with up to 100% mortality rates. There are no interventions available to treat or prevent MrNV disease however. Here we show the structure of MrNV virus-like particles (VLPs) produced by recombinant expression of the capsid protein, using cryogenic electron microscopy. Our data show that MrNV VLPs package nucleic acids in a manner reminiscent of other known nodavirus structures. The structure of the capsid however shows striking differences from insect and fish infecting nodaviruses, which have been shown to assemble trimer-clustered T = 3 icosahedral virus particles. MrNV particles have pronounced dimeric blade-shaped spikes extending up to 6 nm from the outer surface of the capsid shell. Our structural analysis supports the assertion that MrNV may belong to a new genus of the Nodaviridae. Moreover, our study provides the first structural view of an important pathogen affecting aquaculture industries across the world.