ICTV Virus Taxonomy Profile: *Ampullaviridae*

David Prangishvili,* Mart Krupovic* and ICTV Report Consortium

**Abstract**

The family *Ampullaviridae* includes viruses with linear dsDNA genomes that replicate in hyperthermophilic archaea from the genus *Acidianus*. The virions have a unique champagne bottle-shaped morphology and consist of a nucleoprotein filament condensed into a cone-shaped core, which is encased by an envelope, with the base of the ‘bottle’ decorated with a ring of 20 filaments. Genome replication is presumably carried out by the virus-encoded protein-primed family B DNA polymerase. The bottle-shaped morphology is unprecedented among viruses of bacteria and eukaryotes and represents a group of archaea-specific virion morphotypes. This is a summary of the International Committee on Taxonomy of Viruses (ICTV) Report on the taxonomy of the *Ampullaviridae*, which is available at [www.ictv.global/report/ampullaviridae](http://www.ictv.global/report/ampullaviridae).

**Table 1.** Characteristics of the family *Ampullaviridae*

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<th>Typical member: Acidianus bottle-shaped virus (EF432053), species Acidianus bottle-shaped virus, genus Ampullavirus</th>
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**VIRION**

The distinctive bottle-shaped virions are 230±20 nm long, and vary in width from 75 nm at the broad end, tapering to 4±1 nm. The twenty thin filaments at the broad end are each 20×3 nm, regularly spaced and interconnected via a basal disc or ring (Table 1, Fig. 1) [1].

A 9 nm-thick virion envelope encases a cone-shaped core formed by a toroidally supercoiled nucleoprotein filament, which is 7 nm in width.

**GENOME**

The genome is a linear double-stranded DNA molecule of 23 814 bp with 590 bp inverted terminal repeats. It has a base composition of 35% GC and is predicted to encode 57 proteins [2] (Fig. 2). Three genes contain

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Abbreviations: DNAP, DNA polymerase; Cas4-like, Cas4-like nuclease; TK, thymidylate kinase; RHH, ribbon–helix–helix motif; GTase, glycosyltransferase; wHTH, winged helix-turn–helix motif.
putative internal start codons with ribosome-binding sites. The genome encodes a DNA polymerase, a putative glycosyltransferase, a thymidylate kinase, a Cas4-like endonuclease and two putative DNA-binding proteins with winged helix-turn-helix and ribbon-helix-helix motifs, respectively. All of these proteins are conserved in two other ampullavirus genomes described from metagenomics studies [3]. The other predicted proteins have no known homologues. The genome also encodes a putative non-coding RNA, hypothesized to be involved in genome packaging [2].

REPLICATION
The viral DNA polymerase is homologous to protein-primed family B DNA polymerases and is apparently responsible for genome replication [2]. Virus adsorption appears to occur through the pointed end of the virion [1]. The virions are released without apparent host cell lysis.

TAXONOMY
The single genus *Ampullavirus* includes the single species *Acidianus bottle-shaped virus*. Related, unclassified, viruses have been identified by metagenomics studies of material from hot springs in Iceland, Italy and the USA [3]. Protein-primed DNA polymerases homologous to that encoded by *Acidianus* bottle-shaped virus have also been described in members of the archaeal virus genera *Gammapleolipovirus* (family Pleolipoviridae) and *Salterprovirus*, as well as in bacterial and eukaryotic viruses of the families *Tectiviridae*, *Podoviridae* (subfamily *Picovirinae*), *Adenoviridae* and *Lavedaviridae* (genus *Mavirus*) [4–6].

**Fig. 2.** Genome organization of *Acidianus* bottle-shaped virus, showing the location, size and direction of putative genes. The black square indicates the position of a putative non-coding RNA gene. Functionally annotated genes are highlighted with different colours. Numbers below the genome diagram are ORF identifiers. Abbreviations: DNAP, DNA polymerase; Cas4-like, Cas4-like nuclease; TK, thymidylate kinase; RHH, ribbon-helix-helix motif; GTase, glycosyltransferase; wHTH, winged helix-turn-helix motif.

**REFERENCES**


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Conflicts of interest
The authors declare that there are no conflicts of interest.

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