



# ICTV Virus Taxonomy Profile: Partitiviridae

## Citation

Vainio, Eeva J., Sotaro Chiba, Said A. Ghabrial, Edgar Maiss, Marilyn Roossinck, Sead Sabanadzovic, Nobuhiro Suzuki, Jiatao Xie, and Max Nibert. 2018. "ICTV Virus Taxonomy Profile: Partitiviridae." *The Journal of General Virology* 99 (1): 17-18. doi:10.1099/jgv.0.000985. <http://dx.doi.org/10.1099/jgv.0.000985>.

## Published Version

doi:10.1099/jgv.0.000985

## Permanent link

<http://nrs.harvard.edu/urn-3:HUL.InstRepos:37067885>

## Terms of Use

This article was downloaded from Harvard University's DASH repository, and is made available under the terms and conditions applicable to Other Posted Material, as set forth at <http://nrs.harvard.edu/urn-3:HUL.InstRepos:dash.current.terms-of-use#LAA>

## Share Your Story

The Harvard community has made this article openly available.  
Please share how this access benefits you. [Submit a story](#).

[Accessibility](#)



# ICTV Virus Taxonomy Profile: *Partitiviridae*

Eeva J. Vainio,<sup>1,\*</sup> Sotaro Chiba,<sup>2</sup> Said A. Ghabrial,<sup>3</sup> Edgar Maiss,<sup>4</sup> Marilyn Roossinck,<sup>5</sup> Sead Sabanadzovic,<sup>6</sup> Nobuhiro Suzuki,<sup>7</sup> Jiatao Xie,<sup>8</sup> Max Nibert<sup>9</sup> and ICTV Report Consortium

## Abstract

The *Partitiviridae* is a family of small, isometric, non-enveloped viruses with bisegmented double-stranded (ds) RNA genomes of 3–4.8 kbp. The two genome segments are individually encapsidated. The family has five genera, with characteristic hosts for members of each genus: either plants or fungi for genera *Alphapartitivirus* and *Betapartitivirus*, fungi for genus *Gammapartitivirus*, plants for genus *Deltapartitivirus* and protozoa for genus *Cryspovirus*. Partitiviruses are transmitted intracellularly via seeds (plants), oocysts (protozoa) or hyphal anastomosis, cell division and sporogenesis (fungi); there are no known natural vectors. This is a summary of the International Committee on Taxonomy of Viruses (ICTV) Report on the taxonomy of the *Partitiviridae*, which is available at [www.ictv.global/report/partitiviridae](http://www.ictv.global/report/partitiviridae).

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

<b>Typical member:</b>	<b><i>Atkinsonella hypoxylon virus</i>, 2H (RNA1, L39125; RNA2, L39126), species <i>Atkinsonella hypoxylon virus</i>, genus <i>Betapartitivirus</i></b>
Genome	3–4.8 kbp of linear bisegmented dsRNA
Virion	Isometric, non-enveloped, 25–43 nm in diameter; dsRNA1 and dsRNA2 are separately encapsidated
Replication	Cytoplasmic. Genomic RNA acts as a template for mRNA synthesis within the virus particle; transcription occurs by a semiconservative mechanism
Translation	From monocistronic positive-sense transcripts of both genomic dsRNAs
Host range	Plants, fungi and protozoa
Taxonomy	Five genera, including >40 species, and 15 species unassigned to a genus

## VIRION

Virus particles are isometric, non-enveloped, and 25–43 nm in diameter (Table 1, Fig. 1a, b). Each capsid is composed of 120 copies of a single protein arranged as 60 dimers with  $T=1$  icosahedral symmetry [1]. Dimeric surface protrusions are frequently observed on viral capsids. One or two molecules of RNA-dependent RNA polymerase (RdRP) are packaged inside each particle [2].

## REPLICATION

Each dsRNA is monocistronic. The RdRP is believed to function as both a transcriptase and a replicase and catalyzes *in vitro* end-to-end transcription of each dsRNA to produce mRNA by a semi-conservative mechanism. Virions accumulate in the cytoplasm.

## GENOME

Members of all five genera possess two essential genome segments, dsRNA1 and dsRNA2, each containing one large ORF on the positive-strand RNA molecule (Fig. 2). The smaller of the two dsRNA genome segments usually encodes the coat protein (CP) and the larger usually encodes the virion-associated RNA polymerase. The linear dsRNA segments are separately encapsidated. Additional dsRNA segments (satellite or defective) may also be present.

## TAXONOMY

### *Alphapartitivirus*

Members of the genus *Alphapartitivirus* infect either plants, or ascomycetous or basidiomycetous fungi. The two

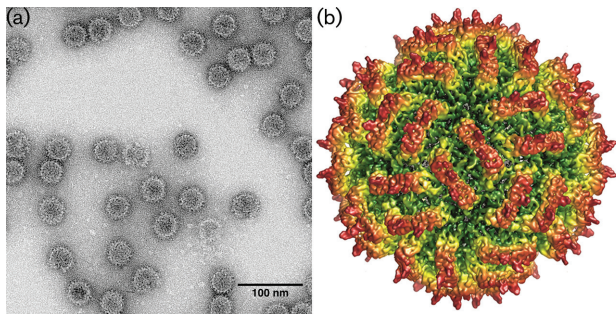
Received 21 November 2017; Accepted 23 November 2017

**Author affiliations:** <sup>1</sup>Natural Resources Institute Finland (Luke), Helsinki 00790, Finland; <sup>2</sup>Asian Satellite Campuses Institute, Nagoya University, Nagoya 464-0861, Japan; <sup>3</sup>Department of Plant Pathology, University of Kentucky, Lexington, KY 40546, USA; <sup>4</sup>Institute of Horticultural Production Systems, Leibniz University Hannover, Hannover 30419, Germany; <sup>5</sup>Center for Infectious Disease Dynamics, Pennsylvania State University, University Park, PA 16802, USA; <sup>6</sup>Department of Biochemistry, Molecular Biology, Entomology and Plant Pathology, Mississippi State University, MS 39762, USA; <sup>7</sup>Institute of Plant Science and Resources, Okayama University, Chuo 2-20-1, Kurashiki, 710-0046, Japan; <sup>8</sup>College of Plant Science and Technology, Huazhong Agricultural University, Wuhan 430070, Hubei Province, PR China; <sup>9</sup>Department of Microbiology and Immunobiology, Harvard Medical School, Boston, MA 02115, USA.

\*Correspondence: Eeva J. Vainio, [eeva.vainio@luke.fi](mailto:eeva.vainio@luke.fi)

**Keywords:** *Partitiviridae*; ICTV; taxonomy; *Alphapartitivirus*; *Betapartitivirus*; *Deltapartitivirus*; *Gammapartitivirus*; *Cryspovirus*.

**Abbreviations:** CP, coat protein; RdRP, RNA-dependent RNA polymerase.



**Fig. 1.** (a) Transmission electron micrograph of negatively-stained purified particles of *Penicillium stoloniferum* virus S, a representative member of the genus *Gammapartitivirus*. (b) Cryo-EM reconstructions of *Penicillium stoloniferum* virus S at 0.45 nm resolution, and rendered with radial colour mapping.

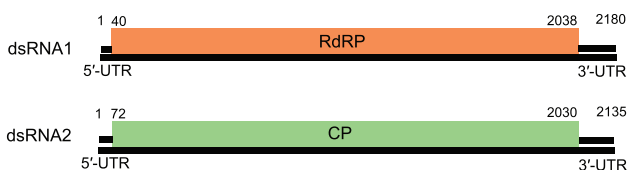
essential dsRNA genome segments are individually about 1.9–2.0 kbp (dsRNA1) and 1.7–1.9 kbp (dsRNA2), typically containing a poly(A) tract near the plus-strand 3′-terminus. There is a single major CP with predicted *Mr* of 51–57 kDa. Plant alphapartitiviruses cause persistent infections, whereas some fungal alphapartitiviruses cause host effects, such as hypovirulence or a reduced growth rate [3, 4].

### **Betapartitivirus**

Members of the genus *Betapartitivirus* infect either plants, or ascomycetous or basidiomycetous fungi. The two essential dsRNA genome segments are about 2.2–2.4 kbp (dsRNA1) and 2.1–2.4 kbp (dsRNA2), typically containing a poly(A) tract near the plus-strand 3′-terminus. There is a single major CP with predicted *Mr* of 71–77 kDa. Plant betapartitiviruses cause persistent infections [5, 6]. Some fungal betapartitiviruses cause reduced host virulence and changes in colony morphology [7].

### **Gammapartitivirus**

All known members of the genus *Gammapartitivirus* infect ascomycetous fungi. The two essential dsRNA segments are about 1.6–1.8 kbp (dsRNA1) and 1.4–1.6 kbp (dsRNA2). There is a single major CP with predicted *Mr* of 44–47 kDa. Most gammapartitiviruses seem to induce latent infections. *Aspergillus fumigatus* partitivirus 1, a related, unclassified virus, has been associated with host effects.



**Fig. 2.** *Atkinsonella hypoxylon* virus [10], an isolate of the type species of the genus *Betapartitivirus*, has a bipartite genome consisting of dsRNA1 and dsRNA2.

### **Deltapartitivirus**

All known members of the genus *Deltapartitivirus* induce persistent infections in plants [8]. They are transmitted by ovule and pollen to the seed embryo. The two essential dsRNA segments are individually 1.6–1.7 kbp (dsRNA1) and 1.4–1.6 kbp (dsRNA2). There is a single major CP with predicted *Mr* of 38–49 kDa.

### **Cryspovirus**

Members of the genus *Cryspovirus* infect apicomplexan protozoa of the genus *Cryptosporidium* [9]. The viral genome comprises two dsRNA segments, which are individually 1.5 and 1.8 kbp. There is a single major CP with predicted *Mr* of 37 kDa. Virions are disseminated within *Cryptosporidium* oocysts. Infections of the *Cryptosporidium* host cells appear to be latent.

## **RESOURCES**

Full ICTV Online (10th) Report:  
[www.ictv.global/report/partitiviridae](http://www.ictv.global/report/partitiviridae).

### **Funding information**

Production of this summary, the online chapter, and associated resources was funded by a grant from the Wellcome Trust (WT108418AIA).

### **Acknowledgements**

Members of the ICTV Report Consortium are Elliot J. Lefkowitz, Andrew J. Davison, Stuart G. Siddell, Sead Sabanadzovic, Donald B. Smith, Richard J. Orton and Peter Simmonds.

### **Conflicts of interest**

The authors declare that there are no conflicts of interest.

### **References**

1. Nibert ML, Tang J, Xie J, Collier AM, Ghabrial SA *et al*. 3D structures of fungal partitiviruses. *Adv Virus Res* 2013;86:59–85.
2. Nibert ML, Ghabrial SA, Maiss E, Lesker T, Vainio EJ *et al*. Taxonomic reorganization of family *Partitiviridae* and other recent progress in partitivirus research. *Virus Res* 2014;188:128–141.
3. Chiba S, Lin YH, Kondo H, Kanematsu S, Suzuki N. Effects of defective interfering RNA on symptom induction by, and replication of, a novel partitivirus from a phytopathogenic fungus, *Rosellinia necatrix*. *J Virol* 2013;87:2330–2341.
4. Vainio EJ, Hantula J. Taxonomy, biogeography and importance of *Heterobasidium* viruses. *Virus Res* 2016;219:2–10.
5. Lesker T, Rabenstein F, Maiss E. Molecular characterization of five betacryptoviruses infecting four clover species and dill. *Arch Virol* 2013;158:1943–1952.
6. Roossinck MJ. Lifestyles of plant viruses. *Philos Trans R Soc Lond B Biol Sci* 2010;365:1899–1905.
7. Xiao X, Cheng J, Tang J, Fu Y, Jiang D *et al*. A novel partitivirus that confers hypovirulence on plant pathogenic fungi. *J Virol* 2014;88:10120–10133.
8. Sabanadzovic S, Valverde RA. Properties and detection of two cryptoviruses from pepper (*Capsicum annuum*). *Virus Genes* 2011;43:307–312.
9. Nibert ML, Woods KM, Upton SJ, Ghabrial SA. *Cryspovirus*: a new genus of protozoan viruses in the family *Partitiviridae*. *Arch Virol* 2009;154:1959–1965.
10. Oh CS, Hillman BI. Genome organization of a partitivirus from the filamentous ascomycete *Atkinsonella hypoxylon*. *J Gen Virol* 1995;76:1461–1470.