

**Part 1:** **TITLE, AUTHORS, APPROVALS, etc**

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| **Code assigned:** | **2021.090B** |  |
| **Short title:** Create 16 new species in the genus *Vividuovirus* (*Caudoviricetes*) | | |
|  | | |

**Author(s) and email address(es)**

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| Andrew Kropinski |

**List the ICTV Study Group(s) that have seen this proposal**

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| Actinobacteriophage Study Group, Bacterial Viruses Subcommittee |

**ICTV study group comments and response of proposer**

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**Authority to use the name of a living person**

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| --- | --- |
| **Is any taxon name used here derived from that of a living person (Y/N)** | N |

|  |  |  |
| --- | --- | --- |
| **Taxon name** | **Person from whom the name is derived** | **Permission attached (Y/N)** |
|  |  |  |
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**Submission dates**

|  |  |
| --- | --- |
| Date first submitted to SC Chair | May 2021 |
| Date of this revision (if different to above) |  |

**ICTV-EC comments and response of the proposer**

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| Acceptance of proposal 2021.001B.abolish\_Caudovirales by EC53 results in removal of the order *Caudovirales* and families *Myoviridae*, *Podoviridae* and *Siphoviridae*. All underlying taxa are to be assigned directly to the class *Caudoviricetes*. The Excel module of this proposal has been altered to reflect the future changes; however, the Word module has been unaltered while awaiting the ratification vote. |

**Part 2:** **NON-TAXONOMIC PROPOSAL**

**Text of proposal**

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**Part 3:** **TAXONOMIC PROPOSAL**

**Name of accompanying Excel module**

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| --- |
| 2021.090B.R.Vividuovirus\_new\_species |

**Abstract**

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| The Actinobacteriophage Database classifies a group of lytic Gordonia phages into Cluster DE which upon average possess 58.69 kb genomes (67.7mol%G+C) and encode for 88 proteins. We have employed DNA-DNA similarity analysis (VIRIDIC), overall protein similarity (ViPTree) and phylogenetic analysis of the large subunit of the terminase complex to study the phages in GenBank. While our overall conclusion is that they represent a new family, we do not intend to create one at this time, but restrict ourselves to creating new genera for the Subclusters identified by the Actinobacteriophage Database.  The bulk of the phages belonging to this Cluster have been assigned to Subcluster DE1. Based upon our analyses this Subcluster probably contains two genera, one of which, *Vividuovirus*, we have already established. In this proposal we add 16 new species to this genus. |

**Text of proposal**

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| |  | | --- | | **Species demarcation criteria:** Two phages are assigned to the same species if their genomes are more than 95% identical over their genome length for isolates.  These values can be calculated by a number of tools, such as BLASTn – usually calculated using intergenomic distance calculator VIRIDIC [3].  **Genus demarcation criteria:** In search for criteria that create cohesive and distinct genera that are reproducible and monophyletic, the Bacterial Viruses Subcommittee has established 70% nucleotide identity of the genome length as the cut-off for genera. Genus-level groupings should always be monophyletic in the signature genes, as tested with a phylogenetic tree. [9] | |

**Supporting evidence**

**Origin of the name of this taxon:** This taxon is named after Gordonia phage Vivi2.

**History:** The genus *Vividuovirus* was established by Taxonomy Proposal 2018.058B with three species *Gordonia virus Vivi2,* *Gordonia virus Brandonk123* and *Gordonia virus Lennon*. These genomes circularly permuted and are representatives of Subcluster DE1 according to The Actinobacteriophage Database (https://phagesdb.org/subclusters/DE1/).

**ViPTree analysis:** ViPTree analysis ([https://www.genome.jp/viptree/](about:blank); [1]) is based upon Rohwer and Edwards (2002) famous Phage Proteomic Tree [2].

  


**VIRIDIC heat map:** VIRIDIC (Virus Intergenomic Distance Calculator; [3]; [http://rhea.icbm.uni-oldenburg.de/VIRIDIC/](about:blank)) computes pairwise intergenomic distances/similarities amongst phage genomes. Members of the genus are indicated with the blue bar. (High resolution version attached)

**Chart

Description automatically generated**

**Specific Reference:** None

**GenBank Summary:**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Phage name | INSDC | Size (Kb) | GC% | Protein | Overall DNA sequence identity (\*) |
| Gordonia phage Vivi2 | [KU963250.1](https://www.ncbi.nlm.nih.gov/nuccore/KU963250.1) | 59.34 | 67.1 | [89](https://www.ncbi.nlm.nih.gov/genome/browse/#!/proteins/46464/462793%7CGordonia%20phage%20Vivi2/viral%20segment/) | 100 |
| Gordonia phage Jabberwocky | [MN329673.1](https://www.ncbi.nlm.nih.gov/nuccore/MN329673.1) | 59.45 | 67.6 | [84](https://www.ncbi.nlm.nih.gov/genome/browse/#!/proteins/84947/717008%7CGordonia%20phage%20Jabberwocky/viral%20segment/) | 76.6 |
| Gordonia phage Barsten | [MT498035.1](https://www.ncbi.nlm.nih.gov/nuccore/MT498035.1) | 59.50 | 67.7 | [88](https://www.ncbi.nlm.nih.gov/genome/browse/#!/proteins/92650/916839%7CGordonia%20Phage%20Barsten/viral%20segment/) | 77.7 |
| Gordonia phage Geodirt | [MH976512.1](https://www.ncbi.nlm.nih.gov/nuccore/MH976512.1) | 59.50 | 67.7 | [85](https://www.ncbi.nlm.nih.gov/genome/browse/#!/proteins/73812/418510%7CGordonia%20phage%20Geodirt/viral%20segment/) | 77.3 |
| Gordonia phage Stultus | [MH976518.1](https://www.ncbi.nlm.nih.gov/nuccore/MH976518.1) | 57.92 | 67.7 | [80](https://www.ncbi.nlm.nih.gov/genome/browse/#!/proteins/73818/418516%7CGordonia%20phage%20Stultus/viral%20segment/) | 75.9 |
| Gordonia phage Bibwit | [MH976508.1](https://www.ncbi.nlm.nih.gov/nuccore/MH976508.1) | 57.88 | 67.5 | [83](https://www.ncbi.nlm.nih.gov/genome/browse/#!/proteins/73836/418534%7CGordonia%20phage%20Bibwit/viral%20segment/) | 77.4 |
| Gordonia phage Keitabear | [MN329677.1](https://www.ncbi.nlm.nih.gov/nuccore/MN329677.1) | 59.76 | 67.3 | [83](https://www.ncbi.nlm.nih.gov/genome/browse/#!/proteins/84990/717051%7CGordonia%20phage%20Keitabear/viral%20segment/) | 79.9 |
| Gordonia phage Ailee | [MH976507.1](https://www.ncbi.nlm.nih.gov/nuccore/MH976507.1) | 58.47 | 67.5 | [83](https://www.ncbi.nlm.nih.gov/genome/browse/#!/proteins/73842/418540%7CGordonia%20phage%20Ailee/viral%20segment/) | 77.6 |
| Gordonia phage Fosterous | [MH976510.1](https://www.ncbi.nlm.nih.gov/nuccore/MH976510.1) | 59.14 | 67.2 | [87](https://www.ncbi.nlm.nih.gov/genome/browse/#!/proteins/73810/418508%7CGordonia%20phage%20Fosterous/viral%20segment/) | 86.3 |
| Gordonia phage Rofo | [MH479924.1](https://www.ncbi.nlm.nih.gov/nuccore/MH479924.1) | 58.77 | 67.3 | [85](https://www.ncbi.nlm.nih.gov/genome/browse/#!/proteins/71898/399770%7CGordonia%20phage%20Rofo/viral%20segment/) | 87.9 |
| Gordonia phage Tangent | [MH976519.1](https://www.ncbi.nlm.nih.gov/nuccore/MH976519.1) | 58.28 | 67.2 | [88](https://www.ncbi.nlm.nih.gov/genome/browse/#!/proteins/73843/418541%7CGordonia%20phage%20Tangent/viral%20segment/) | 92.5 |
| Gordonia phage Angelicage | [MH651166.1](https://www.ncbi.nlm.nih.gov/nuccore/MH651166.1) | 59.22 | 67.4 | [84](https://www.ncbi.nlm.nih.gov/genome/browse/#!/proteins/72134/400270%7CGordonia%20phage%20Angelicage/viral%20segment/) | 84.2 |
| Gordonia phage Nordenberg | [MH976514.1](https://www.ncbi.nlm.nih.gov/nuccore/MH976514.1) | 57.57 | 67.3 | [84](https://www.ncbi.nlm.nih.gov/genome/browse/#!/proteins/73814/418512%7CGordonia%20phage%20Nordenberg/viral%20segment/) | 86.1 |
| Gordonia phage Galadriel | [MK937594.1](https://www.ncbi.nlm.nih.gov/nuccore/MK937594.1) | 59.40 | 67.4 | [86](https://www.ncbi.nlm.nih.gov/genome/browse/#!/proteins/82575/609643%7CGordonia%20phage%20Galadriel/viral%20segment/) | 81.4 |
| Gordonia phage McKinley | [MK977702.1](https://www.ncbi.nlm.nih.gov/nuccore/MK977702.1) | 59.02 | 67.6 | [88](https://www.ncbi.nlm.nih.gov/genome/browse/#!/proteins/82339/596110%7CGordonia%20terrae%20phage%20McKinley/viral%20segment/) | 80.1 |
| Gordonia phage Paries | [MT639640.1](https://www.ncbi.nlm.nih.gov/nuccore/MT639640.1) | 60.13 | 67.4 | [89](https://www.ncbi.nlm.nih.gov/genome/browse/#!/proteins/94301/980578%7CGordonia%20phage%20Paries/viral%20segment/) | 82.2 |
| Gordonia phage Love | [MT723934.1](https://www.ncbi.nlm.nih.gov/nuccore/MT723934.1) | 60.04 | 67.3 | [91](https://www.ncbi.nlm.nih.gov/genome/browse/#!/proteins/94289/980566%7CGordonia%20phage%20Love/viral%20segment/) | 82.5 |

**(\*) Determined using VIRIDIC [3]**

**Strain:** None

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| **Phage name** | **Accession No.** | **Strain of:** |
| Gordonia phage Sitar | MH153809.1 | *Vividuovirus Lennon* |
| Gordonia phage Charming | MK937601.1 | *Vividuovirus Tangent* |
| Gordonia phage Affeca | MH976506.1 | *Vividuovirus Angelicage* |

**Phylogeny:** The phylogenetic tree was constructed using the terminase large subunit these and related phages with phylogeny.fr in “one click” mode [5]. "The "One Click mode" targets users that do not wish to deal with program and parameter selection. By default, the pipeline is already set up to run and connect programs recognized for their accuracy and speed (MUSCLE for multiple alignment and PhyML for phylogeny) to reconstruct a robust phylogenetic tree from a set of sequences." It also includes the use of Gblocks to eliminate poorly aligned positions and divergent regions. "The usual bootstrapping procedure is replaced by a new confidence index that is much faster to compute. See: Anisimova M., Gascuel O. Approximate likelihood ratio test for branches: A fast, accurate and powerful alternative [6] for details."

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**References:**

1: Nishimura Y, Yoshida T, Kuronishi M, Uehara H, Ogata H, Goto S. ViPTree: the viral proteomic tree server. Bioinformatics. 2017; 33(15):2379-2380. doi:10.1093/bioinformatics/btx157. PubMed PMID: 28379287.

2: Rohwer F, Edwards R. The Phage Proteomic Tree: a genome-based taxonomy for phage. J Bacteriol. 2002 Aug;184(16):4529-35. PubMed PMID: 12142423

3: Moraru C, Varsani A, Kropinski AM. VIRIDIC-A Novel Tool to Calculate the Intergenomic Similarities of Prokaryote-Infecting Viruses. Viruses. 2020 Nov 6;12(11):1268. doi: 10.3390/v12111268. PMID: 33172115; PMCID: PMC7694805.

4: Turner D, Reynolds D, Seto D, Mahadevan P. CoreGenes3.5: a webserver for the determination of core genes from sets of viral and small bacterial genomes. BMC Res Notes. 2013;6:140. doi: 10.1186/1756-0500-6-140. PMID: 23566564.

5: Dereeper A, Guignon V, Blanc G, Audic S, Buffet S, Chevenet F, Dufayard JF, Guindon S, Lefort V, Lescot M, Claverie JM, Gascuel O. Phylogeny.fr: robust phylogenetic analysis for the non-specialist. Nucleic Acids Res. 2008;36(Web Server issue):W465-9. doi: 10.1093/nar/gkn180. Epub 2008 Apr 19. PMID: 18424797.

6: Anisimova M, Gascuel O. Approximate likelihood-ratio test for branches: A fast, accurate, and powerful alternative. Syst Biol. 2006;55(4):539-52. PMID: 16785212. DOI: 10.1080/10635150600755453.

7: Lowe, T.M. and Chan, P.P. (2016) tRNAscan-SE On-line: Search and Contextual Analysis of Transfer RNA Genes. Nucl. Acids Res. 44: W54-57.

8: Zimmermann L, Stephens A, Nam SZ, et al. A Completely Reimplemented MPI Bioinformatics Toolkit with a New HHpred Server at its Core. J Mol Biol. 2018;430(15):2237-2243. doi:10.1016/j.jmb.2017.12.007

9: Turner D, Kropinski AM, Adriaenssens EM. A Roadmap for Genome-Based Phage Taxonomy. Viruses. 2021 Mar 18;13(3):506. doi: 10.3390/v13030506. PMID: 33803862; PMCID: PMC8003253.