

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

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| **Code assigned:** | **2020.008P** |  |
| **Short title:** Create five new genera and 11 new species (*Geplafuvirales*: *Geminiviridae*) | | |
|  | | |

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

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

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| --- |
| *Geminiviridae* and *Tolecusatellitidae* SG |

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

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| --- | --- |
| Date first submitted to SC Chair | July 28, 2020 |
| Date of this revision (if different to above) |  |

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

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

**Text of proposal**

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

**Name of accompanying Excel module**

|  |
| --- |
| 2020.008P.R.Geminiviridae\_5ng\_11nsp.xlsx |

**Abstract**

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| Here we propose to classify new geminiviruses into 11 new species based on species demarcation guidelines already established for the family *Geminiviridae.* Furthermore, we propose to establish five new genera in the family *Geminiviridae* to accommodate (i) the 11 new species identified here, and (ii) two previously classified species that were not assigned to any genera. |

**Text of proposal**

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thresholds** **coupled with phylogenetic support** were proposed and accepted as species demarcation criteria, **11 new unassigned species** have been recently characterized from apple (*Malus domestica* Borkh., [7]), camellia (*Camellia japonica* L., [18]), grapevine (*Vitis vinifera* L., [1]), *Juncus maritimus* Lam. [3], passion fruit (*Passiflora edulis* Sims., [5]), tomato and cleome (*Solanum lycopersicum* L. and *Cleome* sp., [4]), tomato (*Solanum lycopersicum* L., [14]), cactus plants (Cactoideae and Opuntioideae clades, [6] and paper mulberry (*Broussonetia papyrifera*, [13]).  **New genera to be created and species that should be assigned to these genera**  **1. New genus: *Maldovirus***  **1.1 New *Maldovirus* species: *Apple geminivirus 1***  Apple geminivirus 1 (AGV1) has been characterized from asymptomatic *Malus domestica* plants [7]. Its 2932 nt long nucleotide genome sequence shares **less than 64.3% with all other known geminiviruses** within currently established species (Figure 1). This virus is clearly related to previously recognized geminiviruses, based on genome composition, similarities in the origin of replication (5'-TAATATTAC-3'), and the presence of homologous genes. The reconstruction of the evolutionary relationships of the complete genome sequences of various major geminivirus lineages reveals that AGV1 groups separately from all other established geminiviruses, with strong phylogenetic support. Interestingly, AGV1 clusters with two new unassigned geminiviruses that are also described in this taxonomic proposal (grapevine geminivirus A (GGVA) and *Juncus maritimus* geminivirus 1 (JmGV1, Figure 2). AGV1, GGVA and JmGV1 clearly belong to a highly divergent geminivirus lineage and, consequently, we propose here to create a new genus named ***Maldovirus*** (derived from ***Mal****us* ***do****mestica* ***virus***) for accommodating these three highly divergent geminivirus species. In addition, phylogenies based on inferred replication associated protein (Rep) and inferred coat protein (CP) amino acid sequences also confirm that AGV1, GGVA and JmGV1 for a well-supported divergent clade within the geminivirus phylogenetic tree (Figures 3 and 4).  **1.2 New *Maldovirus* species: *Grapevine geminivirus A***  Grapevine geminivirus A (GGVA) has been characterized from asymptomatic *Vitis vinifera* plants [1]. Thirteen GGVA isolates (Table 1) have been isolated from various grapevines conserved in germplasm collections maintained by the United States Department of Agriculture (USA) and Foundation Plant Services at the University of California, Davis (USA). It is important to note that these grapevines were originally sourced from five countries in Asia (China, Israel, Japan and South Korea) and one in Europe (Hungary). Their 2903-2906 nt long nucleotide genome sequences share **less than 66.5% with all other known geminiviruses** within currently established species (Figure 1). Grapevine geminivirus A isolates share >97.1% genome-wide pairwise identity with each other. This virus is clearly related to previously recognized geminiviruses, based on genome composition, similarities in the origin of replication (5'-TAATATTAC-3'), and the presence of homologous genes. As mentioned above, regardless of whether the full genome nucleotide sequence (Figure 2), the inferred replication associated protein (Rep) amino acid sequence (Figure 4), or the inferred CP amino acid sequence (Figure 3) is considered, GGVA, AGV1 and JmGV1 group separately from all other geminiviruses, with strong phylogenetic support.  **1.3 New *Maldovirus* species: *Juncus maritimus geminivirus 1***  Juncus maritimus geminivirus 1 (JmGV1) has been characterized from an asymptomatic uncultivated *Juncus maritimus* plant from France [3]. Its 2740 nt long nucleotide genome sequence shares **less than 66.5% with all other known geminiviruses** within currently established species (Figure 1). This virus is clearly related to previously recognized geminiviruses, based on genome composition, similarities in the origin of replication (5'-TAATATTAC-3'), and the presence of homologous genes. As exemplified above, JmGV1 phylogenetically groups with GGVA and AGV1.  **2. New genus: *Opunvirus***  **2.1 New *Opunvirus* species: *Opuntia virus 1***  Opuntia virus 1 (OpV1) has been characterized from asymptomatic New World Cactaceae plants [6]. Seventy-nine OpV1 isolates have been isolated from cactus plants (belonging to 20 different cactus species from both the Cactoideae and Opuntioideae clades) and from nine cactus-feeding cochineal insects (*Dactylopius* sp.) sampled in the USA and Mexico (Table 1). Their 2940-2962 nt long nucleotide genome sequences share **less than 64.9% with all other known geminiviruses** within currently established species (Figure 1). Opuntia virus 1 genomes share >78.4% genome-wide pairwise identity with each other. In addition, a genotype demarcation threshold of 95% revealed the existence of 15 genetically distinct OpV1 “genotype groups”. Opuntia virus 1 is clearly related to previously recognized geminiviruses, based on genome composition, similarities in the origin of replication (5'-TAATATTAC-3'), and the presence of homologous genes. Additionally, regardless of whether the full genome nucleotide sequence (Figure 2), the inferred replication associated protein (Rep) amino acid sequence (Figure 4), or the inferred CP amino acid sequence (Figure 3) are considered, OpV1 isolates group separately from all other geminiviruses, with strong phylogenetic support and, consequently, we propose creating a new genus named ***Opunvirus*** (derived from ***Opun****tia* ***virus*** *1*) for accommodating this highly divergent geminivirus species.  **3. New genus: *Citlodavirus***  **3.1 New *Citlodavirus* species: *Camellia chlorotic dwarf-associated virus***  Two isolates of Camellia chlorotic dwarf-associated virus (CaCDaV) have been characterized from a diseased *Camellia japonica* plant displaying leaves with chlorosis, deformation and V-shaped margins [7] and from a diseased *Camellia sinensis* plant, respectively. Their 3687-3696 nt long genome sequences share **less than 62.9% with all other known geminiviruses** within currently established species (Figure 1). This virus is clearly related to previously recognized geminiviruses, based on genome organization, similarities in the origin of replication (5'-TAATATTAC-3'), and the presence of homologous genes. The reconstruction of the evolutionary relationships of the complete genome sequences of various major geminivirus lineages reveals that CaCDaV groups separately from all other established geminivirus genera, with strong phylogenetic support. However, CaCDaV clusters with one already established unassigned geminivirus species, *Citrus chlorotic dwarf associated virus* (CCDaV) (Figure 2), and two new unassigned geminiviruses respectively described in this taxonomic proposal and in an independent taxonomic proposal submitted by Dr. Mengji Cao, passion fruit chlorotic mottle virus (PCMoV; Figure 2) and paper mulberry leaf curl virus 2 (PMLCV-2; Figure 2). CaCDaV, CCDaV, PCMoV and PMLCV-2 clearly belong to a highly divergent geminivirus lineage. In addition, phylogenies based on inferred replication associated protein (Rep) and inferred coat protein (CP) amino acid sequences also confirm that CaCDaV, CCDaV, PCMoV and PMLCV-2 group separately from all other geminiviruses (Figures 3 and 4) and, consequently, we propose creating a new genus named ***Citlodavirus*** (derived from ***Cit****rus ch****lo****rotic* ***d****warf* ***a****ssociated* ***virus***) for accommodating these four highly divergent geminivirus species. Noteworthy, these four species have a similar genomic organization.  **3.2 New *Citlodavirus* species: *Passion fruit chlorotic mottle virus***  Passion fruit chlorotic mottle virus (PCMoV) has been characterized from a diseased *Passiflora edulis* plant displaying symptoms of chlorosis, crinkling and leaf deformation [5]. Its 3743 nt long nucleotide genome sequence shares **less than 62% with all other known geminiviruses** within currently established species (Figure 1). This virus is clearly related to previously recognized geminiviruses, based on genome organisation, similarities in the origin of replication (5'-TAATATTAC-3'), and the presence of homologous genes. As mentioned above, regardless of whether the full genome nucleotide sequence (Figure 2), the inferred replication associated protein (Rep) amino acid sequence (Figure 4), or the inferred CP amino acid sequence (Figure 3) is considered, CaCDaV, CCDaV, PCMoV and PMLCV-2 group separately from all other geminiviruses, with strong phylogenetic support.  **3.3 New *Citlodavirus* species: *Paper mulberry leaf curl virus 2***  This new species is described in an independent taxonomic proposal submitted by Dr. Mengji Cao.  **4. New genus: *Topilevirus***  **4.1 New *Topilevirus* species: *Tomato apical leaf curl virus***  Tomato apical leaf curl virus (ToALCV) has been characterized from diseased *Solanum lycopersicum* plants displaying symptoms of leaf interveinal yellowing and curling symptoms and root hypotrophy [14]. Three ToALCV isolates have been isolated from tomato plants in Argentina (Table 1). Their 2873-2874 nt long nucleotide sequences share **less than 64.5% genome-wide identity with all other known geminiviruses** within currently established species (Figure 1). ToALCV isolates share >98.9% genome-wide pairwise identity with each other. This virus is clearly related to previously recognized geminiviruses, based on genome composition, similarities in the origin of replication (5'-TAATATTAC-3'), and the presence of homologous genes. Interestingly, ToALCV clusters with one new unassigned geminivirus that is described in this taxonomic proposal (tomato geminivirus 1 (TGV1), figures 2 and 3). These two new unassigned species group separately from all other established geminiviruses, with strong phylogenetic support, and, consequently, we propose creating a new genus named ***Topilevirus*** (derived from ***To****mato a****pi****cal* ***le****af curl* ***virus***) for accommodating these two highly divergent geminivirus species. While phylogenies based on the full genome nucleotide sequence and inferred replication associated protein (Rep) indicate that ToALCV and TGV1 cluster most closely with capulaviruses (Figures 2 and 4), the phylogeny based on inferred coat protein (CP) amino acid sequences shows that ToALCV and TGV1 CPs cluster with the CPs of the turncurtovirus, tomato pseudo-curly top virus (Figure 3).  **4.2 New *Topilevirus* species: *Tomato associated geminivirus 1***  Tomato geminivirus 1(TGV1) has been characterized from *Solanum lycopersicum* and *Cleome* sp. plants from Brazil [4]. Whereas one of the two TGV1 isolates was discovered in an asymptomatic tomato plant, the other was found in a cleome plant presenting with mild yellowing, chlorosis and distortion of the top leaves (Table 1). However, the cleome symptoms were attributed to the cleome plant being co-infected with cleome leaf crumple virus [4]. The TGV1 isolates share 99.96% genome-wide pairwise identity with each other and **less than 64.6% with all other known geminiviruses** within currently established species (Figure 1). As mentioned above, TGV1 clusters with ToALCV, and both unassigned species group separately from all other established geminiviruses, with strong phylogenetic support (Figures 2, 3 and 4).  **5. New genus: *Mulcrilevirus***  **5.1 New *Mulcrilevirus* species: *Mulberry crinkle leaf virus***  Mulberry crinkle leaf virus (MCLV) and mulberry mosaic dwarf associated virus (MMDaV) have been characterized from diseased mulberry plants displaying crinkle leaf symptoms and mosaic and dwarfing symptoms, respectively [8, 9]. Ten MMDaV isolates and one MCLV isolate have been isolated from mulberry plants in China (Table 1). Their 2952-2953 nt long nucleotide sequences share **less than 60.9% genome-wide identity with all other known geminiviruses** within currently established species (Figure 1).  **MCLV and MMDaV isolates share >96.9% genome-wide pairwise identity with each other, indicating that they belong to the same species. While MCLV was published before MMDaV, we propose that the eleven isolates all belong to the species *Mulberry crinkle leaf virus.***  This virus is clearly related to previously recognized geminiviruses, based on genome composition, similarities in the origin of replication (5'-TAATATTAC-3'), and the presence of homologous genes. Interestingly, MCLV clusters with one new unassigned geminivirus that is described in an independent taxonomic proposal submitted by Dr. Mengji Cao (paper mulberry leaf curl virus 1 (PMLCV-1), figures 2 and 3). Additionally, regardless of whether the full genome nucleotide sequence (Figure 2), the inferred replication associated protein (Rep) amino acid sequence (Figure 4), or the inferred CP amino acid sequence (Figure 3) are considered, MCLV and PMLCV-1 isolates group separately from all other geminiviruses with strong phylogenetic support, and, consequently, we propose creating a new genus named ***Mulcrilevirus*** (derived from ***Mul****berry* ***cri****nkle* ***le****af* ***virus***) for accommodating these two highly divergent geminivirus species.  **5.2 New *Mulcrilevirus* species: *Paper mulberry leaf curl virus 1***  This new species is described in an independent taxonomic proposal submitted by Dr. Mengji Cao.  **Table 1.** Summary of the 11 new proposed species in the family *Geminiviridae* and 5 new genera. The new species and genera are highlighted in red font.   |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | | **Genera** | **Species** | **Accession #** | **Virus name** | **Acronym** | **Isolate** | **Country** | **host** | | *Maldovirus* | *Apple geminivirus 1* | KM386645 | Apple geminivirus 1 | AGV1 | CN-PL-2015-13 | China | *Malus domestica* | | *Maldovirus* | *Grapevine geminivirus A* | KX570609 | Grapevine geminivirus A | GGVA | KR-Black Beet-16 | South Korea | *Vitis vinifera* cv. Black Beet | |  |  | KX570617 | Grapevine geminivirus A | GGVA | JP-Koshu Sanjaku-16 | Japan | *Vitis vinifera* cv. Koshu Sanjaku | |  |  | KX570612 | Grapevine geminivirus A | GGVA | JP- Kyoho-16 | Japan | *Vitis vinifera* cv. Kyoho | |  |  | KX574323 | Grapevine geminivirus A | GGVA | CN-Longyan2-16 | China | *Vitis vinifera* L. | |  |  | KX570611 | Grapevine geminivirus A | GGVA | CN-Longyan-16 | China | *Vitis vinifera* L. Longyan | |  |  | KX570607 | Grapevine geminivirus A | GGVA | KR-Nagano Purple-15 | South Korea | *Vitis vinifera* cv. Nagano Purple | |  |  | KX570615 | Grapevine geminivirus A | GGVA | JP-Nehelescol-16 | Japan | *Vitis vinifera* cv. Nehelescol | |  |  | KX570613 | Grapevine geminivirus A | GGVA | JP-Neo-Muscat-16 | Japan | *Vitis vinifera* cv. Neo-Muscat | |  |  | KX570616 | Grapevine geminivirus A | GGVA | JP-Pione-16 | Japan | *Vitis vinifera* cv. Pione | |  |  | KX570618 | Grapevine geminivirus A | GGVA | HU-Scolokertek Kiralynoje-16 | Hungary | *Vitis vinifera* cv. Scolokertek Kiralynoje | |  |  | KX570614 | Grapevine geminivirus A | GGVA | KR-Shine Muscat-16 | South Korea | *Vitis vinifera* cv. Shine Muscat | |  |  | KX570610 | Grapevine geminivirus A | GGVA | JP-Super Hamburg-16 | Japan | *Vitis vinifera* L. Super Hamburg | |  |  | KX618694 | Grapevine geminivirus A | GGVA | IL-Tamar-16 | Israel | *Vitis vinifera* L. | | *Maldovirus* | *Juncus maritimus geminivirus 1* | MG001958 | *Juncus maritimus* geminivirus 1 | JmGV1 | FR-13-FMN-1-12 | France | *Juncus maritimus* | | *Opunvirus* | *Opuntia virus 1* | MN099960 | Opuntia virus 1 | OpV1 | US-2013\_1-2015 | Arizona, USA | *Lophocereus schottii* | |  |  | MN099981 | Opuntia virus 1 | OpV1 | US-2013\_2-2015 | Arizona, USA | *Lophocereus schottii* | |  |  | MN099982 | Opuntia virus 1 | OpV1 | US-2013\_3-2015 | Arizona, USA | *Lophocereus schottii* | |  |  | MN099983 | Opuntia virus 1 | OpV1 | US-2014\_1-2015 | Arizona, USA | *Opuntia stenopetala* | |  |  | MN099984 | Opuntia virus 1 | OpV1 | US-2014\_2-2015 | Arizona, USA | *Opuntia stenopetala* | |  |  | MN099985 | Opuntia virus 1 | OpV1 | US-2014\_3-2015 | Arizona, USA | *Opuntia stenopetala* | |  |  | MN099986 | Opuntia virus 1 | OpV1 | US-2014\_4-2015 | Arizona, USA | *Opuntia stenopetala* | |  |  | MN099987 | Opuntia virus 1 | OpV1 | US-2014\_5-2015 | Arizona, USA | *Opuntia stenopetala* | |  |  | MN099961 | Opuntia virus 1 | OpV1 | US-ASU\_PP2-2018 | Arizona, USA | *Cylindropuntia fulgida* | |  |  | MN099962 | Opuntia virus 1 | OpV1 | MX-ASUH\_12-2002 | Baja, California, Mexico | *Opuntia tapona* | |  |  | MN099963 | Opuntia virus 1 | OpV1 | US-ASUH\_16-2010 | Arizona, USA | *Opuntia engelmannii* | |  |  | MN099964 | Opuntia virus 1 | OpV1 | MX-ASUH\_2-2002 | Sonora, Mexico | *Opuntia santa-rita* | |  |  | MN099988 | Opuntia virus 1 | OpV1 | US-Cacti\_2\_1-2017 | Arizona, USA | *Opuntia santa-rita* | |  |  | MN099989 | Opuntia virus 1 | OpV1 | US-Cacti\_2\_2-2017 | Arizona, USA | *Opuntia santa-rita* | |  |  | MN099990 | Opuntia virus 1 | OpV1 | US-DBG10\_5-2017 | Arizona, USA | *Opuntia cespitosa* | |  |  | MN099991 | Opuntia virus 1 | OpV1 | US-DBG10\_9-2017 | Arizona, USA | *Opuntia cespitosa* | |  |  | MN099992 | Opuntia virus 1 | OpV1 | US-DBG10\_149-2017 | Arizona, USA | *Opuntia cespitosa* | |  |  | MN099993 | Opuntia virus 1 | OpV1 | US-DBG10\_1972-2017 | Arizona, USA | *Opuntia cespitosa* | |  |  | MN099994 | Opuntia virus 1 | OpV1 | US-DBG10\_2558-2017 | Arizona, USA | *Opuntia cespitosa* | |  |  | MN099995 | Opuntia virus 1 | OpV1 | US-DBG10\_2562-2017 | Arizona, USA | *Opuntia cespitosa* | |  |  | MN099996 | Opuntia virus 1 | OpV1 | US-DBG13\_5-2017 | Arizona, USA | *Opuntia basilaris* | |  |  | MN099997 | Opuntia virus 1 | OpV1 | US-DBG13\_9-2017 | Arizona, USA | *Opuntia basilaris* | |  |  | MN099998 | Opuntia virus 1 | OpV1 | US-DBG13\_1987-2017 | Arizona, USA | *Opuntia basilaris* | |  |  | MN100000 | Opuntia virus 1 | OpV1 | US-DBG\_14\_1-2017 | Arizona, USA | *Opuntia echios* var. echios | |  |  | MN100001 | Opuntia virus 1 | OpV1 | US-DBG\_14\_2-2017 | Arizona, USA | *Opuntia echios* var. echios | |  |  | MN100002 | Opuntia virus 1 | OpV1 | US-DBG\_14\_3-2017 | Arizona, USA | *Opuntia echios* var. echios | |  |  | MN100003 | Opuntia virus 1 | OpV1 | US-DBG\_14\_4-2017 | Arizona, USA | *Opuntia echios* var. echios | |  |  | MN100013 | Opuntia virus 1 | OpV1 | US-DBG\_46-2018 | Arizona, USA | *Opuntia echios* var. echios | |  |  | MN100014 | Opuntia virus 1 | OpV1 | US-DBG\_47-2018 | Arizona, USA | *Opuntia echios* var. echios | |  |  | MN100015 | Opuntia virus 1 | OpV1 | US-DBG\_48-2018 | Arizona, USA | *Opuntia echios* var. echios | |  |  | MN100004 | Opuntia virus 1 | OpV1 | US-DBG\_26-2018 | Arizona, USA | *Opuntia rufida* | |  |  | MN100005 | Opuntia virus 1 | OpV1 | US-DBG\_31\_1-2018 | Arizona, USA | *Opuntia mackensenii* | |  |  | MN100006 | Opuntia virus 1 | OpV1 | US-DBG\_31\_2-2018 | Arizona, USA | *Opuntia mackensenii* | |  |  | MN099999 | Opuntia virus 1 | OpV1 | US-DBG34-2018 | Arizona, USA | *Opuntia robusta* | |  |  | MN100007 | Opuntia virus 1 | OpV1 | US-DBG\_34-2018 | Arizona, USA | *Opuntia robusta* | |  |  | MN100008 | Opuntia virus 1 | OpV1 | US-DBG\_36-2018 | Arizona, USA | *Opuntia englemannii x.O. rufida* | |  |  | MN100009 | Opuntia virus 1 | OpV1 | US-DBG\_38-2018 | Arizona, USA | *Opuntia martiniana* | |  |  | MN100010 | Opuntia virus 1 | OpV1 | US-DBG\_41-2018 | Arizona, USA | *Opuntia rooneyi* | |  |  | MN100011 | Opuntia virus 1 | OpV1 | US-DBG\_42\_1-2018 | Arizona, USA | *Opuntia englemannii* | |  |  | MN100012 | Opuntia virus 1 | OpV1 | US-DBG\_42\_2-2018 | Arizona, USA | *Opuntia englemannii* | |  |  | MN099971 | Opuntia virus 1 | OpV1 | US-DBG\_42\_3-2018 | Arizona, USA | *Opuntia englemannii* | |  |  | MN099972 | Opuntia virus 1 | OpV1 | US-DBG\_56-2018 | Arizona, USA | *Opuntia basilaris* | |  |  | MN099973 | Opuntia virus 1 | OpV1 | US-DBG\_57-2018 | Arizona, USA | *Opuntia basilaris* | |  |  | MN099974 | Opuntia virus 1 | OpV1 | US-DBG\_57\_2-2018 | Arizona, USA | *Opuntia basilaris* | |  |  | MN099975 | Opuntia virus 1 | OpV1 | US-DBG\_58-2018 | Arizona, USA | *Opuntia basilaris* | |  |  | MN099976 | Opuntia virus 1 | OpV1 | US-DBG\_72-2018 | Arizona, USA | *Opuntia rufida* | |  |  | MN099965 | Opuntia virus 1 | OpV1 | US-DBG74-2018 | Arizona, USA | *Opuntia robusta* | |  |  | MN099966 | Opuntia virus 1 | OpV1 | US-DBG75-2018 | Arizona, USA | *Opuntia basilaris* | |  |  | MN099967 | Opuntia virus 1 | OpV1 | US-DBG80-2018 | Arizona, USA | *Cylindropuntia echinocarpa* | |  |  | MN099968 | Opuntia virus 1 | OpV1 | US-DBG86-2018 | Arizona, USA | *Cylindropuntia spinosior* | |  |  | MN099977 | Opuntia virus 1 | OpV1 | US-DBG\_86-2018 | Arizona, USA | *Cylindropuntia spinosior* | |  |  | MN099969 | Opuntia virus 1 | OpV1 | US-DBG88-2018 | Arizona, USA | *Opuntia cf polyacantha* | |  |  | MN099970 | Opuntia virus 1 | OpV1 | US-DBG90-2019 | Arizona, USA | *Opuntia phaeacantha* | |  |  | MN100016 | Opuntia virus 1 | OpV1 | US-LCM\_85-2015 | Texas, USA | *Opuntia aureispina* | |  |  | MN100017 | Opuntia virus 1 | OpV1 | US-LCM\_91\_1-2015 | Arizona, USA | *Cylindropuntia arbuscula* | |  |  | MN100018 | Opuntia virus 1 | OpV1 | US-LCM\_91\_2-2015 | Arizona, USA | *Cylindropuntia arbuscula* | |  |  | MN099978 | Opuntia virus 1 | OpV1 | US-S18\_1-2018 | Arizona, USA | *Opuntia engelmannii* | |  |  | MN099979 | Opuntia virus 1 | OpV1 | US-S18\_8-2018 | Arizona, USA | *Opuntia santa-rita* | |  |  | MN099980 | Opuntia virus 1 | OpV1 | US-S18\_89-2018 | Arizona, USA | *Opuntia engelmannii* | |  |  | MN100037 | Opuntia virus 1 | OpV1 | US-TM\_cacti\_2\_1-2018 | Arizona, USA | *Opuntia engelmannii* | |  |  | MN100038 | Opuntia virus 1 | OpV1 | US-TM\_cacti\_2\_2-2018 | Arizona, USA | *Opuntia engelmannii* | |  |  | MN100019 | Opuntia virus 1 | OpV1 | US-SI\_0\_1-2017 | Arizona, USA | *Dactylopius* sp. | |  |  | MN100020 | Opuntia virus 1 | OpV1 | US-SI\_0\_2-2017 | Arizona, USA | *Dactylopius* sp. | |  |  | MN100021 | Opuntia virus 1 | OpV1 | US-SI\_0\_3-2017 | Arizona, USA | *Dactylopius* sp. | |  |  | MN100022 | Opuntia virus 1 | OpV1 | US-SI\_0\_4-2017 | Arizona, USA | *Dactylopius* sp. | |  |  | MN100023 | Opuntia virus 1 | OpV1 | US-SI\_1\_1-2017 | Arizona, USA | *Dactylopius* sp. | |  |  | MN100024 | Opuntia virus 1 | OpV1 | US-SI\_1\_2-2017 | Arizona, USA | *Dactylopius* sp. | |  |  | MN100025 | Opuntia virus 1 | OpV1 | US-SI\_1\_3-2017 | Arizona, USA | *Dactylopius* sp. | |  |  | MN100026 | Opuntia virus 1 | OpV1 | US-SI\_1\_4-2017 | Arizona, USA | *Dactylopius* sp. | |  |  | MN100027 | Opuntia virus 1 | OpV1 | US-SI\_7\_1-2017 | Arizona, USA | *Dactylopius* sp. | |  |  | MN100028 | Opuntia virus 1 | OpV1 | US-SI\_7\_2-2017 | Arizona, USA | *Dactylopius* sp. | |  |  | MN100029 | Opuntia virus 1 | OpV1 | US-SI\_7\_3-2017 | Arizona, USA | *Dactylopius* sp. | |  |  | MN100030 | Opuntia virus 1 | OpV1 | US-SI\_9\_1-2017 | Arizona, USA | *Dactylopius* sp. | |  |  | MN100031 | Opuntia virus 1 | OpV1 | US-SI\_9\_2-2017 | Arizona, USA | *Dactylopius* sp. | |  |  | MN100032 | Opuntia virus 1 | OpV1 | US-SI\_23-2018 | Arizona, USA | *Dactylopius* sp. | |  |  | MN100033 | Opuntia virus 1 | OpV1 | US-SI\_28-2018 | Arizona, USA | *Dactylopius* sp. | |  |  | MN100034 | Opuntia virus 1 | OpV1 | US-SI\_33-2018 | Arizona, USA | *Dactylopius* sp. | |  |  | MN100035 | Opuntia virus 1 | OpV1 | US-SI\_35-2018 | Arizona, USA | *Dactylopius* sp. | |  |  | MN100036 | Opuntia virus 1 | OpV1 | US-SI\_39-2018 | Arizona, USA | *Dactylopius* sp. | | *Citlodavirus* | *Citrus chlorotic dwarf associated virus* | MN509440 | Citrus chlorotic dwarf associated virus | CCDaV | TH-Tha1-19-2019 | Thailand | *Citrus × paradisi* | |  |  | MG566052 | Citrus chlorotic dwarf associated virus | CCDaV | TR-MER52-2017 | Turkey | *Citrus × paradisi* | |  |  | MG566050 | Citrus chlorotic dwarf associated virus | CCDaV | TR-MER46-2017 | Turkey | *Citrus limon* | |  |  | KX840470 | Citrus chlorotic dwarf associated virus | CCDaV | CH-YN-EL4-2015 | China | *Citrus limon* | |  |  | KX840469 | Citrus chlorotic dwarf associated virus | CCDaV | CH-YN-EL3-2015 | China | *Citrus limon* | |  |  | KX840468 | Citrus chlorotic dwarf associated virus | CCDaV | CH-YN-EL2-2015 | China | *Citrus limon* | |  |  | KX840467 | Citrus chlorotic dwarf associated virus | CCDaV | CH-YN-EL1-2015 | China | *Citrus limon* | |  |  | JQ920490 | Citrus chlorotic dwarf associated virus | CCDaV | TR-TK4-1995 | Turkey | *Citrus* sp. | |  |  | MN509442 | Citrus chlorotic dwarf associated virus | CCDaV | TH-Tha30-2019 | Thailand | *Citrus × paradisi* | |  |  | MG566055 | Citrus chlorotic dwarf associated virus | CCDaV | TR-ANT80-2017 | Turkey | *Citrus sinensis* L. | |  |  | MG566053 | Citrus chlorotic dwarf associated virus | CCDaV | TR-HAT62-2017 | Turkey | *Citrus reticulata* | |  |  | MG566051 | Citrus chlorotic dwarf associated virus | CCDaV | TR-MER50-2017 | Turkey | *Citrus × aurantium* | |  |  | MN509441 | Citrus chlorotic dwarf associated virus | CCDaV | TH-Tha1-17-2019 | Thailand | *Citrus × paradisi* | |  |  | MG566054 | Citrus chlorotic dwarf associated virus | CCDaV | TR-ADA74-2017 | Turkey | *Citrus × tangelo* | |  |  | KF561253 | Citrus chlorotic dwarf associated virus | CCDaV | CH-CN001-2009 | China | *Citrus limon* cv. Eureka | | *Citlodavirus* | *Camellia chlorotic dwarf-associated virus* | MG452759 | Camellia chlorotic dwarf-associated virus | CaCDaV | CN-Ca-1 | China | *Camellia japonica* | |  |  | MK613869 | Camellia chlorotic dwarf-associated virus | CaCDaV | CN-HZ1-2017 | China | *Camellia sinensis* | |  | *Passion fruit chlorotic mottle virus* | MG696802 | Passion fruit chlorotic mottle virus | PCMoV | BR-CDS\_MS-2014 | Brazil | *Passiflora edulis* | |  | *Paper mulberry leaf curl virus 2* | MN595127 | Paper mulberry leaf curl virus 2 | PMLCV-2 | CH-SWU-2020 | China | *Broussonetia papyrifera* | |  |  | MN595128 | Paper mulberry leaf curl virus 2 | PMLCV-2 | CH-TL-2018 | China | *Broussonetia papyrifera* | |  |  | MN595126 | Paper mulberry leaf curl virus 2 | PMLCV-2 | CH-HY-2018 | China | *Broussonetia papyrifera* | | *Topilevirus* | *Tomato apical leaf curl virus* | MG491195 | Tomato apical leaf curl virus | ToALCV | AR-Yuto-Tom419-08 | Argentina | *Solanum lycopersicum* | |  |  | MG491196 | Tomato apical leaf curl virus | ToALCV | AR-Yuto-Tom420-08 | Argentina | *Solanum lycopersicum* | |  |  | MG491197 | Tomato apical leaf curl virus | ToALCV | AR-Yuto-Tom424-08 | Argentina | *Solanum lycopersicum* | |  | *Tomato geminivirus 1* | MF072689 | Tomato geminivirus 1 | TGV1 | BR-Cleome-15 | Brazil | *Cleome sp.* | |  |  | MF072688 | Tomato geminivirus 1 | TGV1 | BR-Tomato-15 | Brazil | *Solanum lycopersicum* | | *Mulcrilevirus* | *Mulberry crinkle leaf virus* | MN240483 | Mulberry mosaic dwarf associated virus | MMDaV | CH-ZJTX-2018 | China | *Morus* sp. | |  |  | KP303687 | Mulberry mosaic dwarf associated virus | MMDaV | CH-AK1-8-2014 | China | *Morus* sp. | |  |  | KP699128 | Mulberry mosaic dwarf associated virus | MMDaV | CH-AK1-3-2014 | China | *Morus* sp. | |  |  | KP699129 | Mulberry mosaic dwarf associated virus | MMDaV | CH-AK1-4-2014 | China | *Morus* sp. | |  |  | KP699130 | Mulberry mosaic dwarf associated virus | MMDaV | CH-AK2-14-2014 | China | *Morus* sp. | |  |  | KP699131 | Mulberry mosaic dwarf associated virus | MMDaV | CH-AK2-38-2014 | China | *Morus* sp. | |  |  | KP699132 | Mulberry mosaic dwarf associated virus | MMDaV | CH-AK3-54-2014 | China | *Morus* sp. | |  |  | KP728254 | Mulberry mosaic dwarf associated virus | MMDaV | CH-AK2-18-2014 | China | *Morus* sp. | |  |  | KR131749 | Mulberry crinkle leaf virus | MCLV | CH-js-2012 | China | *Morus alba* L. | |  | *Paper mulberry leaf curl virus 1* | MN595124 | Paper mulberry leaf curl virus 1 | PMLCV-1 | CH-HY-2018 | China | *Broussonetia papyrifera* | |  |  | MN595125 | Paper mulberry leaf curl virus 1 | PMLCV-1 | CH-SWU-2020 | China | *Broussonetia papyrifera* | | |  | |

**Supporting evidence**

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**Figure 1.** Pairwise identity matrix inferred using SDT v1.2 [11].

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**Figure 2**. Unrooted neighbor-joining tree inferred from aligned full-genome nucleotide sequences of representative isolates from the various geminivirus genera. Branches with less than 60% bootstrap support have been collapsed.

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**Figure 3.** Maximum- likelihood phylogenetic tree, applying the rtREV+G+F+I amino acid substitution models for CP of representative geminivirus genera. Numbers associated with branches bootstrap support for these branches. The tree is rooted with CP sequences of representative genomoviruses. Branches with less than 60% bootstrap support have been collapsed.

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**Figure 4**. Maximum- likelihood phylogenetic tree, applying the rtREV+G+I amino acid substitution models for Rep of representative geminivirus genera. Numbers associated with branches bootstrap support for these branches. The tree is rooted with Rep sequences of representative genomoviruses. Branches with less than 60% bootstrap support have been collapsed.

**References**

1. Al Rwahnih M, Alabi OJ, Westrick NM, Golino D, Rowhani A (2016) Description of a novel monopartite geminivirus and its defective subviral genome in grapevine. Phytopathol 107:240-251. PMID: 27670772 DOI: 10.1094/PHYTO-07-16-0282-R

2. Brown JK, Zerbini FM, Navas-Castillo J, Moriones E, Ramos-Sobrinho R, Silva JC, Fiallo-Olive E, Briddon RW, Hernandez-Zepeda C, Idris A, Malathi VG, Martin DP, Rivera-Bustamante R, Ueda S, Varsani A (2015) Revision of begomovirus taxonomy based on pairwise sequence comparisons. Arch Virol 160:1593-1619. PMID: 25894478 DOI: 10.1007/s00705-015-2398-y

3. Claverie S, Bernardo P, Kraberger S, Hartnady P, Lefeuvre P, Lett JM, Galzi S, Filloux D, Harkins GW, Varsani A, Martin DP, Roumagnac P (2018) From Spatial metagenomics to molecular characterization of plant viruses: a geminivirus case study. Adv Virus Res 101:55-83. PMID: 29908594 DOI: 10.1016/bs.aivir.2018.02.003

4. Fontenele RS, Lamas NS, Lacorte C, Lacerda ALM, Varsani A, Ribeiro SG (2017) A novel geminivirus identified in tomato and cleome plants sampled in Brazil. Virus Res 240:175-179. PMID: 28843502 DOI: 10.1016/j.virusres.2017.08.007

5. Fontenele RS, Abreu RA, Lamas NS, Alves-Freitas DMT, Vidal AH, Poppiel RR, Melo FL, Lacorte C, Martin DP, Campos MA, Varsani A, Ribeiro SG (2018) Passion fruit chlorotic mottle virus: molecular characterization of a new divergent geminivirus in Brazil. Viruses 10:169. PMID: 29614801 DOI: 10.3390/v10040169

6. Fontenele RS, Salywon AM, Majure LC, Cobb IN, Bhaskara A, Avalos-Calleros JA, Arguello-Astorga GR, Schmidlin K, Khalifeh A, Smith K, Schreck J, Lund MC, Kohler M, Wojciechowski MF, Hodgson WC, Puente-Martinez R, Van Doorslaer K, Kumari S, Verniere C, Filloux D, Roumagnac P, Lefeuvre P, Ribeiro SG, Kraberger S, Martin DP, Varsani A (2020) A novel divergent geminivirus identified in asymptomatic New World cactaceae plants. Viruses 12: 398. PMID: 32260283 DOI: 10.3390/v12040398

7. Liang P, Navarro B, Zhang Z, Wang H, Lu M, Xiao H, Wu Q, Zhou X, Di Serio F, Li S (2015) Identification and characterization of a novel geminivirus with monopartite genome infecting apple trees. J Gen Virol 96:2411-2420. PMID: 25934791 DOI: 10.1099/vir.0.000173

8. Lu QY, Wu ZJ, Xia ZS, Xie LH (2015) Complete genome sequence of a novel monopartite geminivirus identified in mulberry (Morus alba L.). Arch Virol 160:2135-2138. PMID: 26077515 DOI: 10.1007/s00705-015-2471-6

9. Ma Y, Navarro B, Zhang Z, Lu M, Zhou X, Chi S, Di Serio F, Li S (2015) Identification and molecular characterization of a novel monopartite geminivirus associated with mulberry mosaic dwarf disease. J Gen Virol 96:2421-2434. PMID: 25953916 DOI: 10.1099/vir.0.000175

10. Muhire B, Martin DP, Brown JK, Navas-Castillo J, Moriones E, Zerbini FM, Rivera-Bustamante R, Malathi VG, Briddon RW, Varsani A (2013) A genome-wide pairwise-identity-based proposal for the classification of viruses in the genus Mastrevirus (family Geminiviridae). Arch Virol 158:1411-1424. PMID: 23340592 DOI: 10.1007/s00705-012-1601-7

11. Muhire BM, Varsani A, Martin DP (2014) SDT: a virus classification tool based on pairwise sequence alignment and identity calculation. PLoS One 9:e108277. PMID: 25259891 PMCID: PMC4178126 DOI: 10.1371/journal.pone.0108277

12. Pringle CR (1999) Virus taxonomy--1999. The universal system of virus taxonomy, updated to include the new proposals ratified by the International Committee on Taxonomy of Viruses during 1998. Arch Virol 144:421-429. PMID: 10470265 DOI: 10.1007/s007050050515

13. Qiu Y, Zhang S, Yu H, Xuan Z, Yang L, Zhan B, Murilo Zerbini F, Cao M (2020) Identification and characterization of two novel geminiviruses associated with paper mulberry (Broussonetia papyrifera) leaf curl disease. Plant Dis DOI:10.1094/PDIS-12-19-2597-RE

14. Vaghi Medina CG, Teppa E, Bornancini VA, Flores CR, Marino-Buslje C, Lopez Lambertini PM (2017) Tomato apical leaf curl virus: a novel, monopartite geminivirus detected in tomatoes in Argentina. Front Microbiol 8:2665. PMID: 29375528 DOI: 10.3389/fmicb.2017.02665

15. Varsani A, Martin DP, Navas-Castillo J, Moriones E, Hernandez-Zepeda C, Idris A, Murilo Zerbini F, Brown JK (2014) Revisiting the classification of curtoviruses based on genome-wide pairwise identity. Arch Virol 159:1873-1882. PMID: 24463952 DOI: 10.1007/s00705-014-1982-x

16. Varsani A, Navas-Castillo J, Moriones E, Hernandez-Zepeda C, Idris A, Brown JK, Murilo Zerbini F, Martin DP (2014) Establishment of three new genera in the family Geminiviridae: Becurtovirus, Eragrovirus and Turncurtovirus. Arch Virol 159:2193-2203. PMID: 24658781 DOI: 10.1007/s00705-014-2050-2

17. Varsani A, Roumagnac P, Fuchs M, Navas-Castillo J, Moriones E, Idris A, Briddon RW, Rivera-Bustamante R, Murilo Zerbini F, Martin DP (2017) Capulavirus and Grablovirus: two new genera in the family Geminiviridae. Arch Virol 162:1819-1831. PMID: 28213872 DOI: 10.1007/s00705-017-3268-6

18. Zhang S, Shen P, Li M, Tian X, Zhou C, Cao M (2018) Discovery of a novel geminivirus associated with camellia chlorotic dwarf disease. Arch Virol 163:1709-1712. PMID: 29500570 DOI: 10.1007/s00705-018-3780-3