MODULE 1: **TITLE, AUTHORS, etc**

Code assigned:	*2015.015a,bP*	(to be completed by ICTV officers)

Short title: 56 new and 22 deleted species in the genus *Begomovirus*
(e.g. 6 new species in the genus *Zetavirus*)

Modules attached (modules 1 and 10 are required)	**1** ☒ **2** ☒ **3** ☐ **4** ☐ **5** ☐ **6** ☐ **7** ☒ **8** ☐ **9** ☐ **10** ☒

Author(s):

F.M. Zerbini and J. Navas-Castillo, on behalf of the *Geminiviridae* Study Group

Corresponding author with e-mail address:

F.M. Zerbini, zerbini@ufv.br

List the ICTV study group(s) that have seen this proposal:

A list of study groups and contacts is provided at http://www.ictvonline.org/subcommittees.asp . If in doubt, contact the appropriate subcommittee chair (fungal, invertebrate, plant, prokaryote or vertebrate viruses)	*Geminiviridae*

ICTV Study Group comments (if any) and response of the proposer:

Date first submitted to ICTV: 15 June 2015
Date of this revision (if different to above):

ICTV-EC comments and response of the proposer:

creating and naming one or more new species.

If more than one, they should be a group of related species belonging to the same genus. All new species must be placed in a higher taxon. This is usually a genus although it is also permissible for species to be "unassigned" within a subfamily or family. Wherever possible, provide sequence accession number(s) for **one** isolate of each new species proposed.

Code	*2015.015aP*	(assigned by ICTV officers)

To create 56 new species within:

Fill in all that apply.
- If the higher taxon has yet to be created (in a later module, below) write "**(new)**" after its proposed name.
- If no genus is specified, enter "**unassigned**" in the genus box.

Genus:	*Begomovirus*
Subfamily:	
Family:	*Geminiviridae*
Order:	

Name of new species:	Representative isolate: (only 1 per species please)	GenBank sequence accession number(s)
See Table 1.		

Table 1. Proposed new species, isolate name, and corresponding GenBank accession numbers. Accession numbers refer to DNA-A and DNA-B (when available) components for bipartite viruses or the single component for monopartite viruses.

Species name	Isolate name	GenBank access #
Abutilon golden mosaic virus	Abutilon golden mosaic virus - [Mexico:Yucatan:2007]	KC430935
Capraria yellow spot virus	Capraria yellow spot virus - [Mexico:Yucatan:Conkal:2007]	KC426927, KC426928
Cassava mosaic Madagascar virus	Cassava mosaic Madagascar virus - [Madgascar:Toliary:2006]	HE617299, HE617300
Catharanthus yellow mosaic virus	Catharanthus yellow mosaic virus - [Pakistan:Lahore:KN4]	HE580234
Chenopodium leaf curl virus	Chenopodium leaf curl virus - [USA:Florida:Citra:2007]	HM626515
Chilli leaf curl India virus	Chilli leaf curl India virus - [India:2008]	FM877858
Chilli leaf curl Kanpur virus	Chilli leaf curl Kanpur virus [India:Kanpur:2008]	HM007106
Chilli leaf curl Vellanad virus	Chilli leaf curl Vellanad virus - [India:Vellanad:2008]	HM007121
Clerodendron yellow mosaic virus	Clerodendron yellow mosaic virus - [India:Iari:2006]	EF408037
Clerodendrum golden mosaic China virus	Clerodendrum golden mosaic China virus - [China:Fuzhou 7:2007]	FJ011668, FJ011669
Clerodendrum golden mosaic Jiangsu virus	Clerodendrum golden mosaic Jiangsu virus - [China:Jiangsu XY2:2008]	FN396966
Corchorus yellow vein mosaic virus	Corchorus yellow vein mosaic virus - [India:Maharashtra:2011]	KC196077
Cotton chlorotic spot virus	Cotton chlorotic spot virus - [Brazil:Campina Grande B012:2009]	KF358470
Crassocephalum yellow vein virus	Crassocephalum yellow vein virus - [China:Jinhong:2005]	EF165536
Emilia yellow vein virus	Emilia yellow vein virus - [China:Fuzhou 1:2007]	EU377539
French bean leaf curl virus	French bean leaf curl virus - [India:Kanpur:2011]	JQ866297
Hedyotis uncinella yellow mosaic virus	Hedyotis uncinella yellow mosaic virus - [Vietnam:VN1]	KF429251
Hemidesmus yellow mosaic virus	Hemidesmus yellow mosaic virus - [India:Tirupati:H1:2012]	KC898543
Jatropha leaf curl virus	Jatropha leaf curl virus - [India:New Delhi:2007]	EU798996
Jatropha mosaic Nigeria virus	Jatropha mosaic Nigeria virus - [Nigeria:2:2011]	JX025358
Jatropha mosaic virus	Jatropha mosaic virus - [Jamaica:Spanish Town 1:2004]	KF723258, KF723261
Jatropha yellow mosaic virus	Jatropha yellow mosaic virus - [India:Kathaupahadi:2008]	FJ177030
Malvastrum leaf curl Philippines virus	Malvastrum leaf curl Philippines virus - [Philippines:Mc1:2012]	KC577540
Mesta yellow vein mosaic Bahraich virus	Mesta yellow vein mosaic Bahraich virus - [India:Bahraich:2007]	EU360303
Pepper yellow leaf curl virus	Pepper yellow leaf curl virus - [China:YN65-1:2010]	KC149938
Pouzolzia golden mosaic virus	Pouzolzia golden mosaic virus - [China:TY01:2012]	JX183732
Pouzolzia mosaic Guangdong virus	Pouzolzia mosaic Guangdong virus - [Taiwan:Miaoli:ML13W1:2013]	KF414123
Premna leaf curl virus	Premna leaf curl virus - [Vietnam:VN7:2011]	JQ793786
Rhynchosia yellow mosaic India virus	Rhynchosia yellow mosaic India virus - [India:Thiruvananthapuram:JRH1:2009]	HM777508, HM777510

Sauropus leaf curl virus	Sauropus leaf curl virus - [Thailand:Kamphaengsaen:AFSP5e:2010]	JN809819
Sida ciliaris golden mosaic virus	Sida ciliaris golden mosaic virus - [Venezuela:Lara:M3:2009]	JX857691
Sida common mosaic virus	Sida common mosaic virus - [Brazil:Coimbra 4:2007]	EU710751
Sida golden mosaic Brazil virus	Sida golden mosaic Brazil virus - [Brazil:Mato Grosso do Sul:2007]	FN436001
Sida golden mosaic Lara virus	Sida golden mosaic Lara virus - [Venezuela:Lara:M1:2009]	JX857693
Sida yellow leaf curl virus	Sida yellow leaf curl virus - [Brazil:Coimbra3:2007]	EU710750
Sidastrum golden leaf spot virus	Sidastrum golden leaf spot virus - [Brazil:DF334:2010]	HM357458
Soybean chlorotic blotch virus	Soybean chlorotic blotch virus - [Nigeria:Soybean 19:2007]	GQ472985, GQ472986
Spinach yellow vein virus	Spinach yellow vein virus - [India:Sikar:AS22]	KF660223
Sunn hemp leaf distortion virus	Sunn hemp leaf distortion virus - [India:Barrackpore 1:2008]	FJ455449
Sweet potato leaf curl Henan virus	Sweet potato leaf curl Henan virus - [China:Henan 10:2012]	KC907406
Sweet potato leaf curl Sichuan virus 1	Sweet potato leaf curl Sichuan virus 1 - [China:Sichuan 15:2012]	KC488316
Sweet potato leaf curl Sichuan virus 2	Sweet potato leaf curl Sichuan virus 2 - [China:Sichuan 14:2012]	KF156759
Tobacco leaf curl Comoros virus	Tobacco leaf curl Comoros virus - [Comoros:Simboussa:2004]	AM701760
Tomato bright yellow mosaic virus	Tomato bright yellow mosaic virus - [Brazil:BA167:2012]	KC791690
Tomato bright yellow mottle virus	Tomato bright yellow mottle virus - [Brazil:TO167:2008]	KC791691
Tomato golden leaf distortion virus	Tomato golden leaf distortion virus - [Brazil:TO45:2007]	HM357456
Tomato interveinal chlorosis virus	Tomato interveinal chlorosis virus - [Brazil:Pernambuco:Mdc2681:2004]	JF803252
Tomato leaf curl Liwa virus	Tomato leaf curl Liwa virus - [Oman:Liwa:LW1:2012]	HF912280
Tomato leaf curl New Delhi virus 2	Tomato leaf curl New Delhi virus 2 - [India:IANDS1:2011]	JQ897969
Tomato leaf curl New Delhi virus 4	Tomato leaf curl New Delhi virus 4 - [India:Junagad:TC306:2011]	KF551592
Tomato leaf curl Palampur virus	Tomato leaf curl Palampur virus - [India:Palampur:2007]	AM884015, AM992534
Tomato leaf curl Patna virus	Tomato leaf curl Patna virus - [India:Patna:2008]	EU862323
Tomato leaf curl Rajasthan virus	Tomato leaf curl Rajasthan virus - [India:Rajasthan:2005]	DQ339117
Tomato leaf curl Sulawesi virus	Tomato leaf curl Sulawesi virus - [Indonesia:Sulawesi:Langowan F101:2006]	FJ237614
Velvet bean severe mosaic virus	Velvel bean severe mosaic virus - [India:Lucknow:2008]	FN543425, FN543426
Vigna yellow mosaic virus	Vigna yellow mosaic virus - [Mexico:Morelos:Yautepec:2007]	KC430936

1. All have distinctively begomovirus-like genome organization.
2. All are associated with the whitefly vector *Bemisia tabaci*.
3. Phylogenetically, they all group within the *Begomovirus* genus (see Module 10, Figure 1, for phylogenetic trees).
4. All taxa proposed as new species meet the current species demarcation threshold of <91% nucleotide sequence identity when considering the DNA-A component or the monopartite genome of the isolate (the DNA-B component of bipartite viruses is not taxonomically informative), when implementing the Muscle alignment method to compute pairwise identity comparisons (one minus Hamming distances of pairwise aligned sequences with pairwise deletion of gaps). This is the approach recently described by the *Geminiviridae* Study Group for the three main genera in the family (Brown *et al.*, 2015; Muhire *et al.*, 2013; Varsani *et al.*, 2014).

New begomovirus species continue to be reported on a regular basis. This is partly due to ease of detection (small circular DNA genomes that can be readily amplified by rolling-circle amplification in a sequence-unbiased fashion) but also reflects (i) the great diversity of this group of viruses, and (ii) the fact that many groups have turned their attention to non-cultivated plants: isolates of 31 out of the 56 proposed new species were obtained from non-cultivated plants. The sequences of all 56 proposed new species were obtained by conventional (Sanger) sequencing of a full-length clone, using a primer-walking strategy. Assembly methods varied with each specific sequence, but included the most commonly used programs such as BioEdit, DNABaser, DNAMan, DNAStar and VectorNTI (Table A1, Annex).

Use this module whenever an existing taxon needs to be removed:
  – *Either* to abolish a taxon entirely (when only part (a) needs to be completed)
  – *Or* to move a taxon and re-assign it e.g. when a species is moved from one genus to another (when BOTH parts (a) and (b) should be completed)

Part (a) taxon/taxa to be removed or moved

Code	*2015.015bP*	(assigned by ICTV officers)

To remove the following taxon (or taxa) from their present position:

Abutilon Brazil virus
Ageratum leaf curl Cameroon virus
Bhendi yellow vein India virus
Bitter gourd yellow vein virus
Eclipta yellow vein virus
Hollyhock leaf crumple virus
Honeysuckle yellow vein Kagoshima virus
Kenaf leaf curl virus
Macroptilium yellow net virus
Malvastrum leaf curl Guangdong virus
Malvastrum yellow leaf curl virus
Malvastrum yellow vein Changa Manga virus
Okra leaf curl Cameroon virus
Okra yellow mottle Iguala virus
Okra yellow vein mosaic virus
Sida golden mosaic Honduras virus
Sida golden mosaic Liguanea virus
Sida yellow vein Madurai virus
Soybean chlorotic spot virus
Soybean crinkle leaf virus
Tomato leaf curl Kumasi virus
Tomato mosaic leaf curl virus

The present taxonomic position of these taxon/taxa:

Genus:	*Begomovirus*	
Subfamily:		Fill in all that apply.
Family:	*Geminiviridae*	
Order:		

If the taxon/taxa are to be abolished (i.e. not reassigned to another taxon) write "yes" in the box on the right   **YES**

Reasons to justify the removal:
Explain why the taxon (or taxa) should be removed

Following the reassessment of the species demarcation criteria in the genus *Begomovirus* (Brown *et al.*, 2015), the *Geminiviridae* Study Group is reevaluating the status of all current species. For the above listed species, it was found that one or more isolates have >91% identity, for the monopartite genome or the DNA-A, with isolates of other species (Table 2). Therefore, these species should be merged. The older species is being maintained, and all isolates of the deleted species will be renamed accordingly.

Table 2. List of species to be deleted from the genus *Begomovirus*. Isolates belonging to these species were found to have >91% nucleotide sequence identity with isolates belonging to other species. The GenBank access numbers of the relevant isolates are presented, as well as the percent identity between their nucleotide sequences (whole genome in the case of monopartite viruses, DNA-A component in the case of bipartite viruses).

Deleted species	Access #	Merges with	Access #	% id.
Abutilon Brazil virus	FN434438	*Abutilon mosaic Brazil virus*	JF694480	**93**
Ageratum leaf curl Cameroon virus	FR873229	*Tomato leaf curl Ghana virus*	HE659517	**91**
Bhendi yellow vein India virus	GU112039	*Bhendi yellow vein mosaic virus*	GU112056	**94**
Bitter gourd yellow vein virus	AM491590	*Tomato leaf curl New Delhi virus*	AM747291	**91**
Eclipta yellow vein virus	GQ478343	*Hollyhock leaf curl virus*	FR772082	**91**
Hollyhock leaf crumple virus	AY036009	*Cotton leaf curl Gezira virus*	AF014881	**99**
Honeysuckle yellow vein Kagoshima virus	AB178949	*Honeysuckle yellow vein virus*	AB236323	**92**
Kenaf leaf curl virus	FN806777	*Malvastrum yellow vein virus*	AJ457824	**91**
Macroptilium yellow net virus	JN418998	*Tomato interveinal chlorosis virus*	JF803252	**92**
Malvastrum leaf curl Guangdong virus	AM236779	*Papaya leaf curl Guandong virus*	AJ558122	**91**
Malvastrum yellow leaf curl virus	AJ971524	*Tomato yellow leaf curl China virus*	AM260703	**92**
Malvastrum yellow vein Changa Manga virus	FR715681	*Mesta yellow vein mosaic virus*	FR772081	**91**
Okra leaf curl Cameroon virus	FR717137	*Cotton leaf curl Gezira virus*	FM164726	**98**
Okra yellow mottle Iguala virus	AY751753	*Chino del tomate virus*	AF101476	**91**
Okra yellow vein mosaic virus	AJ002451	*Bhendi yellow vein mosaic virus*	AF241479	**95**
Sida golden mosaic Honduras virus	Y11097	*Sida yellow vein virus*	Y11099	**91**
Sida golden mosaic Liguanea virus	HQ009522	*Sida golden yellow vein virus*	HQ009519	**91**
Sida yellow vein Madurai virus	AM259382	*Sida leaf curl virus*	AM050730	**91**
Soybean chlorotic spot virus	JX122965	*Macroptilium yellow spot virus*	JN419013	**91**
Soybean crinkle leaf virus	AB050781	*Ageratum yellow vein virus*	JN809816	**92**
Tomato leaf curl Kumasi virus	EU847739	*Tomato leaf curl Ghana virus*	EU350585	**91**
Tomato mosaic leaf curl virus	AY508991	*Merremia mosaic virus*	AF068636	**92**

additional material in support of this proposal

References:

Brown JK, Zerbini FM, Navas-Castillo J, Moriones E, Ramos-Sobrinho R, Silva JCF, Fiallo-Olive E, Briddon R, Hernández-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. Archives of Virology 160:1593-1619.

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*). Archives of Virology 158:1411-1424.

Varsani A, Martin DP, Navas-Castillo J, Moriones E, Hernandez-Zepeda C, Idris A, Zerbini FM, Brown JK (2014) Revisiting the classification of curtoviruses based on genome-wide pairwise identity. Archives of Virology 159:1873-1882.

Annex:
Include as much information as necessary to support the proposal, including diagrams comparing the old and new taxonomic orders. The use of Figures and Tables is strongly recommended but direct pasting of content from publications will require permission from the copyright holder together with appropriate acknowledgement as this proposal will be placed on a public web site. For phylogenetic analysis, try to provide a tree where branch length is related to genetic distance.

A

X15983 Abutilon mosaic virus
HM236370 Rhynchosia rugose golden mosaic virus
AF049336 Sida golden mosaic virus
L14460 Tomato mottle virus
JN411687 Sida yellow mottle virus
AJ488768 Tobacco leaf rugose virus
FJ174698 Tomato yellow leaf distortion virus
AF012300 Tomato mottle Taino virus
JX857691 Sida ciliaris golden mosaic virus
Y14874 Tomato mosaic Havana virus
KF723258 Jatropha mosaic virus
FM160943 Tobacco mottle leaf curl virus
AM050143 Tobacco leaf curl Cuba virus
DQ395343 Wissadula golden mosaic St Thomas Virus
HM003779 Sida golden mosaic Florida virus
JX162595 Sida golden mosaic Braco virus
AJ577395 Sida golden yellow vein virus
FJ600483 Malvastrum yellow mosaic Helshire virus
FJ601917 Malvastrum yellow mosaic Jamaica virus
FJ944023 Bean yellow mosaic Mexico virus
AF101476 Chino del tomate virus
DQ520944 Sida mosaic Sinaloa virus
Y11099 Sida yellow vein virus
DQ022611 Okra yellow mosaic Mexico virus
DQ875872 Sida yellow mosaic Yucatan virus
DQ875868 Corchorus yellow spot virus
HQ008338 Sida golden mosaic Buckup virus
GU997691 Sida golden mottle virus
AJ608286 Sinaloa tomato leaf curl virus
HQ201952 Tomato chlorotic leaf distortion virus
X99550 Sida golden mosiac Costa Rica virus
JN848772 Bean chlorotic mosaic virus
M88179 Bean dwarf mosaic virus
EU158096 Macroptilium golden mosaic virus
JN848773 Datura leaf distortion virus
D00940 Potato yellow mosaic virus
JN848770 Bean chlorosis virus
HM357461 Chino del tomate Amazonas virus
HM585443 Sida mosaic Bolivia virus 2
JX871385 Sida mottle Alagoas virus
JX871380 Sida yellow blotch virus
EU914817 Okra mottle virus
AJ557451 Sida micrantha mosaic virus
AY090558 Sida yellow mosaic virus
AJ557450 Sida mottle virus
DQ336350 Tomato yellow spot virus
EU710751 Sida common mosaic virus
JX871383 Sida yellow mosaic Alagoas virus
EU710752 Tomato mild mosaic virus
HM357458 Sidastrum golden leaf spot virus
EU710749 Tomato leaf distortion virus
FN436001 Sida golden mosaic Brazil virus
M88686 Bean golden mosaic virus
JN419021 Macroptilium yellow vein virus
EU710756 Blainvillea yellow spot virus
JN419013 Macroptilium yellow spot virus
JN419002 Centrosema yellow spot virus
HM357456 Tomato golden leaf distortion virus
HM585445 Abutilon mosaic Bolivia virus
HM585441 Sida mosaic Bolivia virus 1
HQ39646 Cleome golden mosaic virus
JF694461 Cleome leaf crumple virus
AF291705 Tomato rugose mosaic virus
DQ207749 Tomato severe rugose virus
K02029 Tomato golden mosaic virus
HM585435 Solanum mosaic Bolivia virus
EF016486 Soybean blistering mosaic virus
JN564749 Tomato dwarf leaf virus
JQ714137 Tomato mottle wrinkle virus
JF803254 Tomato golden vein virus
EF417915 Tomato yellow vein streak virus
AF490004 Tomato chlorotic mottle virus
JF803252 Tomato interveinal chlorosis virus
KC791690 Tomato bright yellow mosaic virus
FJ972767 Passionfruit severe leaf distortion virus
KC706615 Tomato white leaf curl virus
JN848775 Dalechampia chlorotic mosaic virus
KC176780 Tomato yellow mottle virus
EF121755 Boerhavia yellow spot virus
DQ520943 Tomato golden mottle virus
JQ821386 Jacquemontia mosaic Yucatan virus
KC430935 Abutilon golden mosaic virus
DQ875870 Desmodium leaf distortion virus
JX857693 Sida golden mosaic Lara virus
HM626515 Chenopodium leaf curl virus
AF480940 Cotton leaf crumple virus
EU710750 Sida yellow leaf curl virus
EU710754 Tomato common mosaic virus
JF694480 Abutilon mosaic Brazil virus
KC791691 Tomato bright yellow mottle virus
JN381819 Tomato rugose yellow leaf curl virus
KF358470 Cotton chlorotic spot virus
AF130415 Tomato severe leaf curl virus
U65529 Cabbage leaf curl virus
KC426927 Capraria yellow spot virus
AY928512 Pepper golden mosaic virus
AF110189 Bean calico mosaic virus
KC430936 Vigna yellow mosaic virus
HM163576 Melon chlorotic mosaic virus
AF256200 Cucurbit leaf crumple virus
AF421552 Squash mild leaf curl virus
AY064391 Squash yellow mild mottle virus
FJ619507 Euphorbia yellow mosaic virus
FJ807782 Euphorbia mosaic virus
AY927277 Tomato mild yellow leaf curl Aragua virus
DQ178608 Cabbage leaf curl Jamaica virus
FJ213931 Tobacco yellow crinkle virus
AF139168 Dicliptera yellow mottle virus
L01635 Bean golden yellow mosaic virus
AY044135 Macroptilium yellow mosaic Florida virus
AJ344452 Macroptilium yellow mosaic virus
AY508991 Tomato mosaic leaf curl virus
AY508993 Tomato yellow margin leaf curl virus
GQ334472 Tomato leaf deformation virus
JX827487 Blechum interveinal chlorosis virus
AY339618 Tomato chino La Paz virus
X70418 Pepper huasteco yellow vein virus
DQ347950 Rhynchosia golden mosaic virus
FJ944021 Merremia mosaic Puerto Rico virus
HM236368 Rhynchosia golden mosaic Havana virus
AF449192 Macroptilium mosaic Puerto Rico virus
FJ944019 Rhynchosia mild mosaic virus
DQ644561 Sweet potato leaf curl virus

0.05

B

AJ319675 Tomato yellow leaf China virus
EF165536 Crassocephalum yellow vein virus
HQ162270 Tomato yellow leaf curl Hanoi virus
X63015 Tomato yellow leaf curl Thailand virus
AF414287 Pepper leaf curl virus
DQ641698 Erectites yellow mosaic virus
GU199583 Tobacco curly shoot virus
GU558118 Tomato yellow leaf curl China virus
EU189149 Tomato yellow leaf curl Vietnam virus
DQ871221 Tobacco leaf curl Thailand virus
DQ558125 Papaya leaf curl China virus
AM411424 Euphorbia leaf curl Guangxi virus
EU624503 Tomato leaf curl Taiwan virus
JF265670 Vernonia yellow vein Fujian virus
AM182232 Vernonia yellow vein virus
EU377539 Emilia yellow vein virus
AM238692 Siegesbeckia yellow vein Guangxi virus
AM183224Siegesbeckia yellow vein virus
AB007990 Eupatorium-infecting geminivirus
AB182261 Honeysuckle yellow vein mosaic virus
AF314144 Ageratum yellow vein Sri Lanka virus
AF274349 Tomato leaf curl Sri Lanka virus
Z48182 Tomato leaf curl virus
AY754814 Tomato leaf curl Pune virus
AF188481 Tomato leaf curl Bangladesh virus
HM991146 Tomato leaf curl Joydebpur virus
GU136803 Chilli leaf curl virus
JF177030 Jatropha yellow mosaic virus
AJ437618 Ageratum enation virus
FJ589571 Bhendi yellow vein Shubhaneswar virus
AJ496286 Cotton leaf curl Kokhran virus
AM712436 Pedilathus leaf curl virus
EU910141Tomato leaf curl Kerala virus
EF175733 Radish leaf curl virus
FJ455449 Sunn hemp leaf distortion virus
EF197941 Pumpkin yellow mosaic Malaysia virus
KF551592 Tomato leaf curl New Delhi virus 4
AM260206 Squash leaf curl China virus
EU48704 Squash leaf curl Philippines virus
AM884015 Tomato leaf curl Palampur virus
AJ875157 Tomato leaf curl New Delhi virus
DQ339117 Tomato leaf curl Rajasthan virus
EF602306 Allamanda leaf curl virus
FN396966 Clerodendrum golden mosaic Jiangsu virus
AY795900 Lindernia anagalis yellow vein virus
AY602165 Tomato leaf curl Guangdong virus
FJ487911 Euphorbia leaf curl virus
DQ641695 Mimosa yellow leaf curl virus
DQ641694 Splanthes yellow vein virus
JF694486 Asystasia begomovirus 2
AM701765 Tomato leaf curl Diana virus
AF260241 Cotton leaf curl Gezira virus
AY502936 Tomato leaf curl Mali virus
EF194760 Tomato leaf curl Arusha virus
AM701768 Tomato leaf curl Toliara virus
AJ223191 Chayote yellow mosaic virus
FM210275 Okra yellow crinkle virus
FN555172 Pepper yellow vein Mali virus
AM701756 Tobacco leaf curl Zimbabwe virus
AF261885 Tomato curly stunt virus
JX183732 Pouzolzia golden mosaic virus
KF414123 Pouzolzia mosaic Guangdong virus
EU596959 Ramie mosaic virus
EU487025 Tomato leaf curl Cebu virus
AB377113 Tomato leaf curl Philippines virus
KC577540 Malvastrum leaf curl Philippines virus
JQ793786 Premna leaf curl virus
KF429251 Hedyotis uncinella yellow mosaic virus
HQ180391 Tomato leaf curl Pusa virus
EU862323 Tomato leaf curl Patna virus
AF195782 Tomato leaf curl Laos virus
KC686705 Tomato yellow leaf curl Yunnan virus
EU585781 Pepper leaf curl Yunnan virus
AM236784 Tomato leaf curl Guangxi virus
AM94013 Ageratum yellow vein virus
AJ851005 Ageratum leaf curl virus
EU487046 Tomato leaf curl Mindanao virus
AB100304 Tomato leaf curl Java virus
AJ512761 Tobacco leaf curl Yunnan virus
AF327436 Tomato leaf curl Malaysia virus
AJ876550 Senecio yellow mosaic virus
FJ011668 Clerodendrum golden mosaic China virus
DQ641692 Clerodendrum golden mosaic virus
AY730035 Indian cassava mosaic virus
HM230683 Jatropha mosaic India virus
AJ579307 Sri Lankan cassava mosaic virus
KC898543 Hemidesmus yellow mosaic virus
HM140368 Papaya leaf crumple virus
GQ478342 Rose leaf curl virus
AF084006 Tomato leaf curl virus
JF495184 Papaya leaf curl Guangdong virus
AM048837 Sida yellow mosaic China virus
DQ641696 Sida yellow vein Vietnam virus
AJ810156Stachytarpheta leaf curl virus
KF150142 Tomato leaf curl Hainan virus
AM260699 Malvastrum leaf curl virus
AM050730 Sida leaf curl virus
AF241479 Bhendi yellow vein mosaic virus
KC196077 Corchorus yellow vein mosaic virus
JQ866297 French bean leaf curl virus
AM236755 Malvastrum yellow mosaic virus
AJ744881 Malvastrum yellow vein virus
AJ786711 Malvastrum leaf curl Yunnan virus
EU360303 Mesta yellow vein mosaic Bahraich virus
FJ159269 Mesta yellow vein virus
GU111996 Okra enation leaf curl virus
FR772082 Hollyhock leaf curl virus
JQ897969 Tomato leaf curl New Delhi virus 2
AY705380 Cotton leaf curl Bangalore virus
EU365613 Gossypium darwinii symptomless virus
AF189018 Tomato yellow leaf curl Indonesia virus
AF511529 Tomato yellow leaf curl Kanchanaburi virus
AB267834 Pepper yellow leaf curl Indonesia virus
AM701760 Tobacco leaf curl Comoros virus
DQ127170 Tomato leaf curl Uganda virus
AJ112352 African cassava mosaic virus
AJ865340 Tomato leaf curl Mayotte virus
AJ24565Watermelon chlorotic stunt virus
JX025358 Jatropha mosaic Nigeria virus
EU350585 Tomato leaf curl Ghana virus
AJ422132 South African cassava mosaic virus
AJ717580 East African cassava mosaic Kenya virus
AJ717562 East African cassava mosaic Zanzibar virus
AM701758 Tomato leaf curl Anjouan virus
AJ717542 East African cassava mosaic virus
AJ006460 East African cassava mosaic Malawi virus
AJ865339 Tomato leaf curl Madagascar virus
X61153 Tomato yellow leaf curl Sardinia virus
AY227892 Tomato leaf curl Axarquia virus
X15656 Tomato leaf curl virus
AF271234 Tomato yellow leaf curl Malaga virus
AY04T234 Tomato leaf curl Sudan virus
DQ358913 Tomato yellow leaf curl Mali virus
KC488316 Sweet potato leaf curl Sichuan virus 1
KC907406 Sweet potato leaf curl Henan virus
AF326775 Sweet potato leaf curl Georgia virus
EU253456 Sweet potato leaf curl virus
EF456742 Sweet potato leaf curl Canary virus
HQ393477 Sweet potato leaf curl Sao Paulo virus
FJ969831 Sweet potato leaf curl virus
HQ333144 Sweet potato leaf curl South Carolina virus
FR751068 Sweet potato leaf curl Uganda virus
KF156759 Sweet potato leaf curl Sichuan virus 2
DQ512731 Sweet potato leaf curl virus
JF694484 Asystasia begomovirus 1
GQ472985 Soybean chlorotic blotch virus
AF029217 Cowpea golden mosaic virus
GQ472984 Soybean mild mottle virus
AY271891 Hyacinth bean yellow mosaic Bangladesh virus
FJ539014 Kudzu mosaic virus
FN543425 Velvet bean severe mosaic virus
HM777508 Rhynchosia yellow mosaic India virus
AM999981 Rhynchosia mosaic virus
AM932427 Horsegram yellow mosaic virus
AF416742 Mungbean yellow mosaic India virus
AJ421642 Mungbean yellow mosaic virus
EF546604 Alternanthera yellow vein virus
AM491778 Tomato leaf curl Seychelles virus
AJ965539 Ludwigia yellow vein virus
FJ237614 Tomato leaf curl Sulawesi virus
HM007121 Chilli leaf curl Velland virus
EF408037 Clerodendron yellow mosaic virus
EU798996 Jatropha leaf curl virus
KC149938 Pepper leaf curl Alabad virus
AJ002452 Cotton leaf curl Alabad virus
AJ420319 Squash leaf curl Yunnan virus
AF509739 Loofa yellow mosaic virus
HE580234 Catharanthus yellow mosaic virus
FM877858 Chilli leaf curl India virus
AF314531 Pepper leaf curl Bangladesh virus
DQ114477 Chilli leaf curl virus
HF912280 Tomato leaf curl Liwa virus
DQ629102 Tomato leaf curl New Delhi virus
Y15934 Papaya leaf curl virus
JN135234 Pepper leaf curl Lahore virus
KF660223 Spinach yellow vein virus
HM007106 Chilli leaf curl Kanpur virus
EF532620 Squash leaf curl virus
FJ463902 Corchorus golden mosaic virus
AY727903 Corchorus yellow vein Vietnam virus

0.05

Figure A1. Maximum-likelihood phylogenetic trees based on the complete monopartite genome for monopartite viruses and the DNA-A component of bipartite begomoviruses. Bootstrap values (2,000 replications) are represented as filled circles when >90% and as open circles when between 50% and 89%. **A,** New World begomoviruses; **B,** Old World begomoviruses. New species in this proposal are indicated in green.

Table A1. Sequencing and assembly methods used for obtaining the full-length sequence of the proposed new species in the genus *Begomovirus*.

Species name	GenBank access #	Sequence/Assembly method	Reference
Abutilon golden mosaic virus	KC430935	Sanger/DNAStar	n.a.
Capraria yellow spot virus	KC426927, KC426928	Sanger/DNAStar	n.a.
Cassava mosaic Madagascar virus	HE617299, HE617300	Sanger/DNA Baser	Harimalala et al., Arch Virol 57: 2027, 2012
Catharanthus yellow mosaic virus	HE580234	Sanger/DNAStar	Ilyas et al., Arch. Virol. 158:505, 2013
Chenopodium leaf curl virus	HM626515	Sanger/DNAStar	Ng et al., PLoS ONE 6:E19050, 2011
Chilli leaf curl India virus	FM877858	Sanger/no info	n.a.
Chilli leaf curl Kanpur virus	HM007106	Sanger/no info	n.a.
Chilli leaf curl Vellanad virus	HM007121	Sanger/DNAStar	Sharma et al., Plant Cell Rep 34:1389, 2015
Clerodendron yellow mosaic virus	EF408037	Sanger/no info	Sivalingam et al., Acta Virol 55:357, 2011
Clerodendrum golden mosaic China virus	FJ011668, FJ011669	Sanger/DNAStar	Li & Zhou, Virus Genes 41:250, 2010
Clerodendrum golden mosaic Jiangsu virus	FN396966	Sanger/DNAStar	Li & Zhou, Virus Genes 41:250, 2010
Corchorus yellow vein mosaic virus	KC196077	Sanger/no info	n.a.
Cotton chlorotic spot virus	KF358470	Sanger/Staden	Almeida et al., Genome Announc 1:e00661-13, 2013
Crassocephalum yellow vein virus	EF165536	Sanger/DNAMan	Dong et al., J. Phytopathol. 156:193, 2008
Emilia yellow vein virus	EU377539	Sanger/DNAStar	Yang et al., J Plant Pathol 90:475, 2008
French bean leaf curl virus	JQ866297	Sanger/BioEdit	Kamaal et al., Virus Genes 46:120, 2013
Hedyotis uncinella yellow mosaic virus	KF429251	Sanger/DNAStar	Du et al., Virus Genes 48:557, 2014
Hemidesmus yellow mosaic virus	KC898543	Sanger/BioEdit	Reddy et al., Arch. Virol. 159:1223, 2014
Jatropha leaf curl virus	EU798996	Sanger/no info	n.a.
Jatropha mosaic Nigeria virus	JX025358	Sanger/no info	Kashina et al., Arch. Virol. 158:511, 2013
Jatropha mosaic virus	KF723258, KF723261	Sanger/DNAStar	Simmonds-Gordon et al., Arch Virol 159:2815, 2014
Jatropha yellow mosaic virus	FJ177030	Sanger/no info	Snehi et al., Arch. Virol. 156:2303-2307, 2011
Malvastrum leaf curl Philippines virus	KC577540	Sanger/no info	n.a.
Mesta yellow vein mosaic Bahraich virus	EU360303	Sanger/BioEdit	Das et al., Arch. Virol. 153:1791, 2008
Pepper yellow leaf curl virus	KC149938	Sanger/no info	n.a.
Pouzolzia golden mosaic virus	JX183732	Sanger/DNAStar	Tang et al., Arch. Virol. 158:1617, 2013
Pouzolzia mosaic Guangdong virus	KF414123	Sanger/DNAStar	Tang et al., Arch. Virol. 159:2799, 2014

Premna leaf curl virus	JQ793786	Sanger/DNAStar	She et al., Arch. Virol. 158:2425, 2013
Rhynchosia yellow mosaic India virus	HM777508, HM777510	Sanger/no info	Jyothsna et al., Virus Genes 42:407, 2011
Sauropus leaf curl virus	JN809819	Sanger/DNAStar	Shih et al., J Phytopath 161:78, 2013
Sida ciliaris golden mosaic virus	JX857691	Sanger/no info	n.a.
Sida common mosaic virus	EU710751	Sanger/DNA Baser	Castillo-Urquiza et al., Arch Virol 153:1985, 2008
Sida golden mosaic Brazil virus	FN436001	Sanger/BioEdit	Paprotka et al., Virology 404:148, 2010
Sida golden mosaic Lara virus	JX857693	Sanger/no info	n.a.
Sida yellow leaf curl virus	EU710750	Sanger/DNA Baser	Castillo-Urquiza et al., Arch Virol 153:1985, 2008
Sidastrum golden leaf spot virus	HM357458	Sanger/no info	n.a.
Soybean chlorotic blotch virus	GQ472985, GQ472986	Sanger/Vector NTI	Alabi et al., Arch. Virol. 155:643, 2010
Spinach yellow vein virus	KF660223	Sanger/no info	Sahu et al., J Gen Plant Path 81:576, 2015
Sunn hemp leaf distortion virus	FJ455449	Sanger/no info	n.a.
Sweet potato leaf curl Henan virus	KC907406	Sanger/DNAMan	Liu et al., Arch. Virol. 159:1537, 2014
Sweet potato leaf curl Sichuan virus 1	KC488316	Sanger/DNAMan	Liu et al., Virus Genes 47:591, 2013
Sweet potato leaf curl Sichuan virus 2	KF156759	Sanger/no info	n.a.
Tobacco leaf curl Comoros virus	AM701760	Sanger/no info	Lefeuvre et al., J Gen Virol 88:3458, 2007
Tomato bright yellow mosaic virus	KC791690	Sanger/no info	n.a.
Tomato bright yellow mottle virus	KC791691	Sanger/no info	n.a.
Tomato golden leaf distortion virus	HM357456	Sanger/no info	n.a.
Tomato interveinal chlorosis virus	JF803252	Sanger/DNAStar	Albuquerque et al., Arch. Virol. 157:747, 2012
Tomato leaf curl Liwa virus	HF912280	Sanger/DNAStar	Khan et al., Arch. Virol. 159:445, 2014
Tomato leaf curl New Delhi virus 2	JQ897969	Sanger/no info	n.a.
Tomato leaf curl New Delhi virus 4	KF551592	Sanger/no info	n.a.
Tomato leaf curl Palampur virus	AM884015, AM992534	Sanger/no info	Kumar et al., Virus Genes 37:425, 2008
Tomato leaf curl Patna virus	EU862323	Sanger/no info	Kumari et al., Virus Res 152:19, 2010
Tomato leaf curl Rajasthan virus	DQ339117	Sanger/no info	n.a.
Tomato leaf curl Sulawesi virus	FJ237614	Sanger/DNAStar	Tsai et al., Plant Dis. 93:321, 2009
Velvet bean severe mosaic virus	FN543425, FN543426	Sanger/no info	Zaim et al., Virus Genes 43:138, 2011
Vigna yellow mosaic virus	KC430936	Sanger/DNAStar	n.a.