Table S1. Locations of papaya leaf curl isolates collected from papaya and representative isolates used for full length genome sequencing.

Sl. No.	Location of collected isolates			Name assigned
	District	Taluk	Village	
1.	Belagavi	Gokak	Bangwhad	PLC-1[*1]
2.	Belagavi	Gokak	Ghataprabha	PLC-2[*2]
3.	Belagavi	Ramadurga	Thornur	PLC-3[*3]
4.	Bagalkote	Bagalkot	Tulsigeri	PLC-4[*4]
5.	Bagalkote	Bagalkot	Tulsigeri	PLC-5
6.	Bagalkote	Bagalkot	Tulsigeri	PLC-6
7.	Bagalkote	Bilgi	Honakatti	PLC-7[*5]
8.	Bagalkote	Bilgi	Honakatti	PLC-8
9.	Bagalkote	Hungund	Bannihatti	PLC-9[*6]
10.	Bagalkote	Hungund	Bannihatti	PLC-10
11.	Bagalkote	Hungund	Hiremagi	PLC-11[*7]
12.	Bagalkote	Hungund	Hiremagi	PLC-12
13.	Bagalkote	Hungund	Hiremagi	PLC-13
14.	Bagalkote	Hungund	Hiremagi	PLC-14
15.	Bagalkote	Hungund	Hiremagi	PLC-15
16.	Bagalkote	Hungund	Hiremagi	PLC-16
17.	Bagalkote	Hungund	Hiremagi	PLC-17
18.	Kalaburagi	Afzalpur	Anoor	PLC-18[*8]
19.	Kalaburagi	Afzalpur	Anoor	PLC-19
20.	Kalaburagi	Afzalpur	Anoor	PLC-20
21.	Kalaburagi	Afzalpur	Anoor	PLC-21
22.	Kalaburagi	Afzalpur	Tavarkeda	PLC-22[*9]
23.	Kalaburagi	Afzalpur	Tavarkeda	PLC-23
24.	Kalaburagi	Afzalpur	Tavarkeda	PLC-24
25.	Kalaburagi	Kalaburagi	Farahatabad	PLC-25[*10]
26.	Kalaburagi	Kalaburagi	Farahatabad	PLC-26
27.	Kalaburagi	Kalaburagi	Farahatabad	PLC-27
28.	Kalaburagi	Kalaburagi	Hadagalarathi	PLC-28[*11]
29.	Kalaburagi	Kalaburagi	Hadagalarathi	PLC-29
30.	Kalaburagi	Kalaburagi	Hadagalarathi	PLC-30
31.	Vijayapura	Muddebihal	Nidagundi	PLC-31[*12]
32.	Haveri	Haveri	Kancharagatti	PLC-32[*13]

* Representative papaya samples infected by begomoviruses used for full length genome sequencing [*1]OL630090, [*2]OL630091, [*3]OL677445, [*4]OL677443, [*5]OL677444, [*6]OL677446, [*7]OL677447, [*8]OL677448, [*9]OL677449, [*10]OL677450, [*11]OL677451, [*12]OL677452, [*13]OL677453

Table S2. PCR primers and amplification condition used for detection and characterization of begomoviruses infecting papaya.

Primer	Oligonucleotides (5′-3′)	Length (nt)	PCR condition						Remarks	Reference
			Initial-denaturation	No. of cycles	Denaturation	Annealing	Extension	Final extension		
PAL1v1978	GCATCTGCAGGCCCACATYGTCTTYCCNGT	30	94°C for 3 min	30	94°C for 1 min.	55°C for 2 min	72°C for 2 min	72°C for 10 min.	DNA-A	Rojas *et al*. (1993)
PARIc715b	GATTTCTGCAGTTDATRTTYTCRTCCATCCA	31								
PBL1v2040	GCCTCTGCAGCARTGRTCKATCTTCATACA	30	94°C for 3 min	30	94°C for 1 min.	50°C for 1 min.	72°C for 2 min.	72°C for 10 min.	DNA-B	
PCRc1	CTAGCTGCAGCATATTTACRARWATGCCA	29								

Nucleotides at degenerate positions are represented by a single letter of the IUPAC ambiguity code: D=A,G,T; H=A,C,T; K=G,T; M=A,C; N=A,C,G,T; R=A,G; W=A,T; Y=C,T.. Degeneracy is the product of the numbers that designate the number of bases or nucleotides that may occur at each position in that primer.

Table S3. GenBank accession numbers of selected begomovirus sequences from database used in this study for analysis of isolated begomoviruses.

Sl. No.	Organism	Accession No.	Acronym
1.	Ageratum enation virus-[India:Rajasthan:CN2:Papaya:2014]	KP725057	AEV-[IN:Raj:CN2:Pap:14]
2.	Ageratum yellow vein virus-[China:Sanya:Papaya:2013]	KM051844	AYVV-[CN:Sanya:Pap:13]
3.	Bhendi yellow vein Bhubhaneswar virus-[India:Orissa:Okra:03]	FJ589571	BYVBV-[IN:OD;Bhu:Okra:03]
4.	Catharanthus yellow mosaic virus-[Pakistan:Faisalabad:ZF-16:Papaya:2009]	LN864815	CaYMV-[PK:Fsd:ZF-16:Pap:10]
5.	Chayote yellow mosaic virus-[Cameroon:Papaya-20-14:Papaya:2014]	KT454822	ChaYMV-[CR:Pap-20-14:Pap:14]
6.	Chilli leaf curl India virus-[India:Meerut:Papaya:2017]	MF574143	ChiLCINV-[IN:Mer:Pap:17]
7.	Chilli leaf curl virus-[Indi:Shahahanpur:PSB-21:Papaya:2014]	MH765693	ChiLCV-[IN:Sha:PBS-21:Pap:14]
8.	Chilli leaf curl virus-[India:Amritsar:Papaya:2009]	GU136803	ChiLCV-[IN:Amr:Pap:09]
9.	Chilli leaf curl virus-[India:Karnataka:Raichuru:Chili:2017]	MK161454	ChiLCV-[IN:Kar:Rai:Chi:17]
10.	Chilli leaf curl virus-[India:Uttar Pradesh: Faizabad: PSB-45:Papaya:2014]	MH765698	ChiLCV-[IN:UP:Faz:PSB-45:Pap:14]
11.	Chilli leaf curl virus-[India:Uttar Pradesh:Mahoba:PSB-42:Papaya:2014]	MH765697	ChiLCV-[IN:UP:Mah:PSB-42:Pap:14]
12.	Chilli leaf curl virus-[Pakistan:WA19:Papaya:2018]	MN839535	ChiLCV-[PK:WA19:Pap:18]
13.	Chilli leaf curl virus-DU [India:New Delhi:DU:Papaya:2009]	HM140364	ChiLCV-DU[IN:ND:DU:Pap:09]
14.	Chilli leaf curl virus-HD [India:New Delhi:HD:Papaya:2007]	HM140365	ChiLCV-HD[IN:ND:HD:Pap:07]
15.	Chilli leaf curl Virus-India [India: New Delhi: AD: Papaya:2005]	DQ989326	ChiLCV-IN[IN:ND:AD:Pap:05]
16.	Chilli leaf curl virus-Najafgarh2 [India:New Delhi:Papaya:2009]	HM140370	ChiLCV-Naj2[IN:ND:Pap:09]
17.	Chilli leaf curl virus-Noida [India:Uttar Pradesh:Noida:Papaya:2009]	HM140371	ChiLCVN-[IN:UP:Noi:Pap:09]
18.	Chilli leaf curl virus-Panipat1 [India:Panipat:Papaya:2008]	HM140366	ChiLVCP1[IN:Pan:Pap:08]
19.	Cotton leaf curl Burewala virus-[India: LK_2N:Papaya:2011]	KX302707	CLCuBuV-[IN:LK_2N:Pap:11]
20.	Croton yellow vein mosaic virus-[India:Hariyana:Acalypha:07]	FN645901	CYVMV-[IN:HR:Acl:07]
21.	Croton yellow vein mosaic virus-[India:New Delhi:Croton:2007]	JN817516	CYVMV-[IN:ND:Cro:08]
22.	Croton yellow vein mosaic virus-[India:Panjab:Acalypha:2007]	FN645926	CYVMV-[IN:Pun:Acl:07]
23.	Croton yellow vein mosaic virus-[India:Ranchi:PSB-38:Papaya:2014]	MH765696	CYVMV-[IN:Ran:PSB-38:Pap:14]
24.	Duranta leaf curl virus-[India: New Delhi:PSB-63:Papaya:2016]	MH807202	DLCV-[IN:ND:PSB-63:Pap:16]
25.	Malvastrum leaf curl virus-[China:Guangxi:G100:Papaya:2006]	AM260699	MaLCuV-[CN:GX:G100:Pap:06]
26.	Mungbean yellow mosaic India virus-[India:New Delhi:Cowpea:2005	DQ389153	MYMIV-[IN:ND:Cp:05]
27.	Okra enation leaf curl virus-[Iran:Bahu Kalat:Papaya:2010]	KJ397529	OELCuV-[IR:BK::Pap:10]
28.	Papaya leaf crumple virus-[India: Mohali:Pap-Moh7:Papaya:2011]	KR052159	PaLCrV-[IN:Moh:Pap-Moh7:Pap:11]
29.	Papaya leaf crumple virus-[India:Bhopal:B2_5N:Papaya:2011]	KX302712	PaLCrV-[IN:Bho:B2_5N:Pap:11]
30.	Papaya leaf crumple virus-[India:Bhopal:PSB-66:Papaya:2016]	MH807203	PaLCrV-[IN:Bho:PSB-66:Pap:16]
31.	Papaya leaf crumple virus-[India:Hajipur:B2_3N:Papaya:2011]	KX302710	PaLCrV-[IN:Haj:B2_3N:Pap:11]
32.	Papaya leaf crumple virus-[India:Jabalpur:PSB-32:Papaya:2016]	MH674437	PaLCrV-[IN:Jab:PSB-32:Pap:11]
33.	Papaya leaf crumple virus-[India:Kolkata:B2_4N:Papaya:2012]	KX302711	PaLCrV-[IN:Kol:B2_4N:Pap:12]
34.	Papaya leaf crumple virus-[India:Lalitpur:PSB-47:Papaya: 2015]	MH807200	PaLCrV-[IN:Lal:PSB-47:Pap:15]
35.	Papaya leaf crumple virus-[India:Lucknow:B2_2N:Papaya:2012]	KX302709	PaLCrV-[IN:Luc:B2_2N:Pap:12]
36.	Papaya leaf crumple virus-[India:Mohali:3B2_2:Papaya:2012]	KX302708	PaLCrV-[IN:Moh:3B2_2:Pap:12]

37.	Papaya leaf crumple virus-[India:New Delhi:PSB-60:Papaya:2016]	MH807201	PaLCrV-[IN:ND:PSB-60:Pap:16]
38.	Papaya leaf crumple virus-[Pakistan:Lahore:KN6:Papaya:2011]	HE580236	PaLCrV-[PK:Lah:KN6:Pap:11]
39.	Papaya leaf crumple virus-Najafgarh1[India:New Delhi:Papaya:2008]	HM140369	PaLCrV-Naj1[IN:ND:Pap:08]
40.	Papaya leaf crumple virus-Nirulas[India:New Delhi:Papaya:2007]	HM140368	PaLCrV-Nirulas[IN:ND:Pap:07]
41.	Papaya leaf crumple virus-Panipat 8 [India:Panipat:Papaya:2008]	HM140367	PaLCrV-Panipat8[IN:Pan:Pap:08]
42.	Papaya leaf crumple virus-Panipat8[India:Haryana:Panipat:Papaya:2008]	NC_014707	PaLCrV-Panipat8[IN:Har:Pan:Pap:08]
43.	Papaya leaf curl China virus-[China:Guangxi:G2:Papaya:2004]	AJ558123	PaLCuV-[CH:Gua:G2:Pap:04]
44.	Papaya leaf curl China virus-[China:Guangxi:G4:Papaya:2004]	AJ811914	PaLCuV-[CH:Gua:G4:Pap:04]
45.	Papaya leaf curl Guandong virus-[China:Guangxi:GD2:Papaya: 2004]	AJ558122	PaLCuGdV-[CH:Gua:GD2:Pap:04]
46.	Papaya leaf curl Guandong virus-[China:Guangxi:GD2:Papaya:2004]	NC_005844	PaLCuGdV-[CH:Gua:GD2:Pap:04]
47.	Papaya leaf curl virus-[India: Hyderabad:PSB-51:Papaya:2016]	MH807204	PaLCuV-[IN:Hyd:PSB-51:Pap:16]
48.	Papaya leaf curl virus-[India: Rajasthan:DP2:Papaya:2015]	KX353622	PaLCuV-[IN:Raj:DP2:Pap:15]
49.	Papaya leaf curl virus-[India: Tamil Nadu:Wellington:WB2&5:Papaya:2010]	KX302713	PaLCuV-[IN:TN:Wel:WB2&5Pap:10]
50.	Papaya leaf curl virus-[India::Rajasthan:MM1:Papaya:2019]	MN529626	PaLCuV-[IN:Raj:MM1::Pap:09]
51.	Papaya leaf curl virus-[India:Gujarat:Jamnagar:PSB-34:Papaya:2015]	MH807205	PaLCuV-[IN:Guj:Jam:PSB-34:Pap:15]
52.	Papaya leaf curl virus-[India:Karnataka:Madikeri:Candela:2017]	MK087120	PaLCuV-[IN:Kar:Madi:Cal:18]
53.	Papaya leaf curl virus-[India:Madhya Pradesh:Pap:ND:13:Papaya:2012]	KF307208	PaLCuV-[IN:MP:Pap:ND:13:Pap:12]
54.	Papaya leaf curl virus-[India:Mohali:New Delhi:Croton:2008]	JN817517	PaLCrV-[IN:ND:Cro:08]
55.	Papaya leaf curl virus-[India:New Delhi:Papaya:2016]	KY800906	PaLCuV-[IN:ND:Pap:16]
56.	Papaya leaf curl virus-[India:New Delhi:Radish:2018]	FJ593629	PaLCuV-[IN:ND:Rad:18]
57.	Papaya leaf curl virus-[South Korea: Korea:Papaya:2014]	KT266873	PaLCuV-[SK:Korea:Pap:14]
58.	Pedilanthus leaf curl virus-[India: Gujarat:Ahmedabad:PSB37:Papaya:2015]	MH765695	PeLCV-[IN:Guj:Amd:PSB37:Pap:15]
59.	Tomato leaf curl Bangladesh virus-[Bangladesh:Gazipur:Papaya:2016]	MH380003	ToLCBV-[BD:Gaz:Pap:16]
60.	Tomato leaf curl Gujarat virus-[India:Lucknow:Papaya:2014]	MG757245	ToLCuGuV-[IN:LukPap:14]
61.	Tomato leaf curl Karnataka virus-India [India:Gujarath:Tomato:2008]	MH5770301	ToLCKV-[IN:GJ:AHM:Tom:16]
62.	Tomato leaf curl Karnataka virus-India [India:Karnataka:Banglore:Chilli:2008]	HM007094	ToLCKV-[IN:Kar:Ben:Chi:08]
63.	Tomato leaf curl Karnataka virus-India [India:Tamilnadu:Tomato:2012]	KF551579	ToLCKV-[IN:TN:Com:Tom:12]
64.	Tomato leaf curl virus-[India:Karnataka:Bengaluru:Chrysanthamum:2017]	MG758145	ToLCV-[In:Kar:Ben:Chr:17]
65.	Tomato leaf curl virus-[India:Tamilnadu:Tomato:2012]	KC713784	ToLCV-[IN:TN:Com:Tom:12]
66.	Tomato yellow leaf curl virus-[USA:P3-T_1-3:Papaya:2014]	KX024639	TYLCV-[USA:P3-T_1-3:Pap:14]

Table S4. Lowest and highest percentage nucleotide identities for pair wise comparisons of the predicted complete sequences and intergenic regions of begomoviruses isolated from papaya and with other begomoviruses.

Gene	Begomovirus	PLC -1 OL630090	PLC -2 OL630091	PLC -3 OL677445	PLC -4 OL677443	PLC - 7 OL677444	PLC -9 OL677446	PLC -11 OL677447	PLC -18 OL677448	PLC -22 OL677449	PLC -25 OL677450	PLC -28 OL677451	PLC -31 OL677452	PLC -32 OL677453
Complete genome	AEV [1][a]	78.6	79.6	79.4	78.1	81.0	80.9	80.9	80.7	79.2	81.0	76.8	78.4	72.8
	AYVY [1][a]	72.6	73.6	73.8	72.3	74.1	75.0	75.2	75.0	74.2	73.7	69.9	72.1	70.1
	BhVBhV [1][a]	84.2	78.5	78.5	85.0	88.6	80.0	80.1	79.6	81.7	87.9	81.9	84.3	72.2
	CaYMV [1][a]	72.1	74.9	74.9	72.7	73.4	76.3	76.5	76.3	74.1	76.4	78.5	76.1	69.2
	ChaYMV [1][a]	66.4	68.1	68.2	66.1	68.5	69.3	69.5	69.6	69.3	69.1	65.9	67.5	66.2
	ChiLCV [13][a]	72.1-78.5	**73.8-96.3**	**73.7-96.5**	72.6-78.6	73.3-80.9	**75.1-98.5**	**75.2-98.5**	**74.9-98.0**	**73.4-93.5**	75.6-78.8	74.6-79.7	74.6-76.8	68.5-80.8
	CLCuV [1][a]	74.7	75.6	75.7	74.6	76.8	77.2	77.2	77.1	74.9	75.8	72.2	74.0	71.9
	CYMV [4][a]	80.5-85.7	73.4-75.9	73.5-76.4	81.2-84.8	81.1-85.2	74.7-77.6	74.9-77.7	74.9-77.4	77.7-80.9	84.8-89.3	**87.7-93.5**	84.4-88.8	67.5-70.0
	DLCV [1][a]	71.9	73.5	73.5	71.9	72.7	74.6	74.6	74.9	72.9	75.0	75.3	73.7	69.8
	MaLCuV [1][a]	74.6	73.5	73.6	74.9	76.2	74.9	75.0	74.8	76.5	76.0	73.3	74.3	707.0
	MYMIV [1][a]	62.2	61.6	61.7	62.2	63.3	62.4	62.5	62.2	61.8	61.0	58.4	59.9	59.6
	OELCuv [1][a]	70.7	70.8	70.9	70.2	72.3	72.3	72.5	72.2	71.1	71.6	68.3	70.7	68.7
	PaLCrV [15][a]	70.0-72.7	72.8-75.5	75.0-75.4	70.0-72.5	72.6-74.8	74.0-76.8	74.2-76.9	74.2-76.9	72.5-75	72.4-74.6	68.2-70.1	70.8-72.7	72.3-74.5
	PaLCuV [15][a]	71.5-87.1	72.9-95.3	73.2-94.1	**70.7-85.4**	**72.6-87.9**	74.5-95.9	74.4-96.0	74.5-96.7	73.6-92.0	**72.9-92.4**	69.3-91.9	**79.0-93.0**	67.9-79.9
	PeLCV [1][a]	75.3	77.9	77.7	75.2	76.5	79.4	79.4	79.3	77.3	76.7	74.0	74.5	71.2
	ToLCV [8][a]	**69.6-88.6**	71.6-84.2	71.3-84.1	69.0-84.7	70.9-86.6	72.7-86.0	72.9-86.0	72.8-85.7	71.1-83.9	70.1-84.9	67.0-82.1	69.5-84.2	**69.7-87.2**
Intergenic region (IR)	AEV [1][a]	60.8	70.0	67.5	60.6	65.4	70.8	70.5	70.6	70.9	63.5	56.4	59.4	53.3
	AYVY [1][a]	52.9	62.7	60.6	51.5	57.3	63.4	63.0	62.7	63.0	54.6	48.4	52.6	54.6
	BhVBhV [1][a]	72.3	75.4	71.6	75.3	**91.0**	75.7	75.4	75.4	76.4	**88.1**	70.3	81.2	58.5
	CaYMV [1][a]	42.5	44.2	41.2	39.5	42.3	43.5	43.2	44.0	44.2	41.3	39.5	40.8	36.3
	ChaYMV [1][a]	45.6	50.0	50.0	42.3	47.3	50.8	50.5	50.8	50.8	45.5	43.1	43.1	42.7
	ChiLCV [13][a]	50.10-67.4	63.1-97.9	**59.6-94.6**	48.3-66.0	55.8-74.1	**62.7-98.3**	**62.40-97.90**	**62.8-97.9**	**63.4-98.9**	53.9-71.5	45.0-68.9	48.9-66.1	62.5-46.7
	CLCuV [1][a]	43.2	41.7	41.4	40.3	41.1	42.5	42.5	41.4	42.0	40.8	40.9	40.0	37.9
	CYMV [4][a]	60.2-64.6	54.90-63.7	53.4-60.3	61.4-78.5	63.6-70.6	55.0-63.6	55.0-63.3	54.5-63.7	55.8-64.3	62.4-76.4	**61.9-83.3**	61.4-72.9	41.8-47.6
	DLCV [1][a]	54.4	60.8	56.4	53.3	53.6	59.2	58.9	59.8	60.8	52.0	57.4	50.7	47.8
	MaLCuV [1][a]	55.7	62.0	60.0	57.5	58.0	62.8	62.5	61.6	62.9	55.1	53.2	50.1	51.9
	MYMIV [1][a]	37.1	37.3	36.1	30.7	33.9	37.6	37.3	37.0	38.1	32.9	33.3	34.4	32.6
	OELCuv [1][a]	51.6	52.8	49.0	46.6	52.7	52.2	51.8	52.8	53.4	50.3	46.9	48.9	53.3
	PaLCrV [15][a]	54.8-58.1	62.2-65.7	60.0-63.2	53.0-55.2	59.8-62.3	62.7-66.3	62.4-66.0	62.5-66.1	62.9-66.4	57.1-59.5	49.5-51.7	53.7-56.8	**73.7-76.5**
	PaLCuV [15][a]	38.80-69.1	42.0-69.1	40.3-67.9	**38.9-81.2**	40.0-73.6	42.1-68.7	42.1-68.7	42.0-69.4	42.3-70.1	37.4-80.2	36.3-77.1	**36.5-84.5**	38.5-59.5
	PeLCV [1][a]	60.0	67.3	64.2	56.2	63.1	66.8	66.5	66.0	67.6	61.3	54.9	58.4	48.5
	ToLCV [8][a]	**42.5-82.3**	**46.2-83.2**	45.6-78.9	42.0-66.4	43.4-72.8	46.0-83.5	46.0-83.2	45.9-82.9	46.5-84.2	40.0-71.0	40.1-62.6	40.8-69.2	49.0-74.6

[a]Number of sequences from the databases used in the comparisons

For each gene the highest value is underlined and bold

AEV: Ageratum enation virus, AYVY: Ageratum yellow vein virus, BhVBhV: Bhendi yellow vein Bhubhaneswar virus, CaYMV: Catharanthus yellow mosaic virus, ChaYMV: Chayote yellow mosaic virus, ChiLCV: Chilli leaf curl virus, CLCuV: Cotton leaf curl, CYMV: Croton yellow vein mosaic virus, DLCV: Duranta leaf curl virus, MaLCuV: Malvastrum leaf curl virus, MYMIV: Mungbean yellow mosaic India virus, OELCuv: Okra enation leaf curl virus, PaLCrV: Papaya leaf crumple virus, PaLCuV: Papaya leaf curl virus, PeLCV: Pedilanthus leaf curl virus, ToLCV: Tomato leaf curl virus

Table S5. Lowest and highest percentage amino acid identities for pair wise comparisons of the predicted gene products of begomoviruses isolated from papaya with other begomoviruses.

Gene	Begomovirus	PLC - 1 OL630090	PLC - 2 OL630091	PLC - 3 OL677445	PLC - 4 OL677443	PLC - 7 OL677444	PLC - 9 OL677446	PLC - 11 OL677447	PLC - 18 OL677448	PLC -22 OL677449	PLC -25 OL677450	PLC -28 OL677451	PLC -31 OL677452	PLC -32 OL677453
AV2	AEV [1][a]	72.8	76.2	78.8	72.8	85.5	82.2	82.2	83.0	81.3	85.5	86.4	58.4	64.4
	AYVY [1][a]	62.0	62.1	64.7	59.6	70.5	66.3	67.2	65.5	63.8	67.2	68.9	48.7	56.0
	BhVBhV [1][a]	79.3	72.7	77.6	79.3	92.5	80.1	80.1	78.5	77.6	91.7	92.5	65.2	60.3
	CaYMV [1][a]	66.9	76.0	80.9	66.1	78.5	84.2	84.2	82.6	79.3	78.5	78.5	56.1	62.8
	ChaYMV [1][a]	52.8	59.6	63.7	51.6	62.9	65.3	66.1	63.7	62.9	61.2	62.9	41.1	52.8
	ChiLCV [13][a]	59.5-73.5	**65.2-86.4**	**67.7-90.6**	61.9-71.9	71.9-83.4	**71.90-95.70**	**71.90-95.70**	**72.70-94.90**	**66.9-89.8**	70.2-83.4	70.2-83.4	52.0-60.3	**57.0-71.1**
	CLCuV [1][a]	72.8	76.2	79.6	72.0	84.7	83.00	83.00	83.00	79.6	83.8	84.7	56.7	62.7
	CYVMV [4][a]	78.8-81.3	73.7-75.4	78.8-79.6	74.5-81.3	89.8-94.9	79.60-82.20	81.30-82.20	79.60-80.50	78.8-80.5	88.9-94.0	89.8-94.9	65.2-66.9	60.1-61.8
	DLCV [1][a]	61.1	66.9	70.2	59.5	70.2	73.50	72.70	73.50	69.4	70.2	71.0	49.5	56.1
	MaLCuV [1][a]	60.3	63.8	67.2	57.1	69.7	69.70	69.70	69.70	66.3	68.0	6.8	46.2	55.1
	MYMIV [1][a]	37.0	33.6	37.8	33.6	41.1	37.80	38.60	38.60	36.1	39.4	39.4	31.9	34.5
	OELCuv [1][a]	51.6	61.4	59.8	51.6	63.1	62.20	63.10	64.70	65.5	62.2	62.2	46.7	50.0
	PaLCrV [15][a]	64.3-70.4	66.9-76.0	66.9-76.0	60.1-66.9	73.7-80.9	70.30-80.10	70.30-80.10	70.30-80.90	68.6-78.5	72.0-78.5	72.0-79.3	49.1-54.5	63.6-68.7
	PaLCuV [15][a]	**54.2-81.3**	57.7-83.0	57.0-86.4	**55.6-81.3**	**65.4-94.9**	59.80-91.50	59.80-91.50	60.50-91.50	59.1-86.4	**63.3-94.0**	**64.0-94.9**	**46.2-66.9**	48.5-68.6
	PeLCV [1][a]	59.7	67.9	68.6	58.2	69.4	72.30	72.30	73.10	69.4	68.6	69.4	47.0	56.7
	ToLCV [8][a]	53.0-79.1	60.5-77.1	63.5-80.5	51.6-77.1	62.7-88.9	66.10-83.80	66.90-83.80	65.50-84.70	63.5-82.2	60.1-88.1	61.0-88.9	44.9-61.8	54.7-66.9
CP (AV 1)	AEV [1][a]	77.7	88.2	86.7	75.5	82.8	92.90	93.30	93.30	80.4	82.8	76.1	77.3	90.2
	AYVY [1][a]	75.4	78.5	76.3	73.3	80.9	81.70	82.10	81.70	79.7	79.7	73.9	75.4	79.7
	BhVBhV [1][a]	85.9	79.2	77.0	83.7	91.0	82.80	83.50	83.20	86.3	90.6	84.3	84.3	82.0
	CaYMV [1][a]	75.0	88.2	87.5	72.8	79.6	94.10	94.10	93.30	79.2	79.2	73.0	74.2	89.8
	ChaYMV [1][a]	68.9	71.3	69.4	67.3	74.8	74.40	75.10	74.40	72.8	73.2	67.8	68.6	72.8
	ChiLCV [13][a]	70.3-76.5	**82.0-92.5**	**80.1-91.4**	68.6-74.4	75.3-81.6	**86.30-98.00**	**86.30-98.00**	**86.7-97.6**	74.6-82.0	74.6-81.2	69.1-75.0	69.5-75.7	**83.5-93.3**
	CLCuV [1][a]	77.3	89.0	87.1	75.9	82.4	93.30	93.70	93.7	80.8	82.4	75.7	76.5	91.0
	CYVMV [4][a]	78.9-93.3	66.7-89.0	64.9-87.1	75.5-91.0	83.5-98.4	69.9-93.3	70.7-93.7	70.3-93.7	79.2-92.1	82.8-98.0	78.5-91.4	**77.7-91.8**	68.7-91.0
	DLCV [1][a]	72.2	81.6	80.9	68.6	75.3	85.5	85.5	85.5	74.6	75.3	69.5	71.0	83.9
	MaLCuV [1][a]	86.3	74.7	73.2	83.3	91.8	77.8	78.20	77.4	87.5	90.6	84.0	85.6	75.8
	MYMIV [1][a]	68.0	70.4	69.3	66.0	73.1	73.9	74.3	73.50	71.2	72.70	66.1	69.6	72.3
	OELCuv [1][a]	68.2	72.4	70.2	65.7	73.6	75.5	76.30	75.50	72.8	72.40	66.6	68.6	73.6
	PaLCrV [15][a]	67.5-76.5	79.2-89.4	78.2-87.9	65.5-74.4	73.4-82.4	83.5-94.5	84.3-94.5	83.90-94.50	73.0-81.6	72.20-81.20	67.5-75.0	66.7-75.7	79.6-91.4
	PaLCuV [15][a]	**68.3-93.3**	55.2-90.6	50.7-89.4	**65.5-91.0**	**71.4-98.4**	59.4-96.0	59.0-96.0	59.00-95.70	**66.7-92.1**	**71.00-98.00**	**71.0-91.4**	64.8-91.7	58.6-91.4
	PeLCV [1][a]	74.2	85.5	84.0	71.7	78.9	90.2	90.2	90.20	78.50	78.50	72.2	73.0	86.7
	ToLCV [8][a]	67.8-92.5	72.0-91.0	69.8-89.4	66.1-90.3	73.6-97.6	74.8-95.7	75.9-96.0	75.5-96.0	71.3-91.7	72.00-97.60	66.6-90.6	67.0-91.4	73.2-92.5
Rep	AEV [1][a]	77.8	77.5	80.8	76.7	79.6	82.5	82.0	82.8	81.7	80.60	73.9	79.3	72.5

(AC 1)	AYVY [1][a]	76.1	74.2	76.7	75.3	77.9	78.3	78.1	79.5	78.1	77.50	70.3	76.8	72.5
	BhVBhV [1][a]	82.8	77.5	80.3	83.3	**87.6**	83.1	82.5	83.1	81.4	**85.50**	74.5	82.3	72.2
	CaYMV [1][a]	69.5	68.6	72.5	72.8	71.3	74.5	73.7	74.2	72.0	79.50	87.2	81.8	64.5
	ChaYMV [1][a]	54.2	53.9	58.1	57.3	57.4	58.9	58.7	60.3	57.8	61.10	61.7	62.5	54.5
	ChiLCV [12][a]	62.0-82.8	**59.2-93.3**	**62.3-95.0**	63.7-82.5	62.8-85.1	**64.2-98.0**	**63.8-97.2**	**64.5-98.6**	**62.8-96.9**	69.20-81.10	70.9-83.6	70-7-79.6	56.7-82.5
	CLCuV [1][a]	75.4	73.8	77.1	74.3	76.8	79.0	78.2	78.7	77.4	75.40	70.2	74.1	71.0
	CYVMV [4][a]	51.5-72.8	49.0-71.4	52.3-75.3	54.5-77.5	52.0-74.3	54.5-77.0	53.0-76.2	53.7-77.0	51.8-75.0	59.00-83.10	**66.2-93.0**	**60.6-85.9**	47.9-65.6
	DLCV [1][a]	70.0	68.6	71.4	73.9	71.6	73.1	72.6	74.2	72.0	78.30	80.8	77.1	65.3
	MaLCuV [1][a]	77.3	75.6	78.7	77.6	80.4	81.2	80.7	80.9	79.5	78.10	70.9	76.8	74.3
	MYMIV [1][a]	70.9	65.4	68.5	71.2	72.7	70.4	69.9	70.1	67.9	68.50	63.5	67.7	65.7
	OELCuv [1][a]	76.5	74.9	77.9	77.1	80.7	80.4	80.2	80.1	78.5	78.20	70.7	78.2	72.7
	PaLCrV [15][a]	66.6-78.3	66.9-77.2	69.1-79.7	66.9-77.8	69.5-80.7	71.6-81.7	71.1-81.2	71.9-82.8	70.7-81.4	68.50-77.50	62.2-67.8	67.9-74.6	65.8-75.3
	PaLCuV [15][a]	63.1-80.1	61.4-87.5	65.9-89.4	64.4-80.1	64.7-83.7	67.0-91.9	66.20-91.4	67.0-92.2	65.00-90.8	67.80-82.80	60.9-92.2	67.2-85.1	55.6-78.3
	PeLCV [1][a]	68.9	66.6	69.2	69.4	71.1	71.2	70.8	71.2	69.4	71.20	66.1	69.6	62.5
	ToLCV [8][a]	**75.0-87.5**	71.7-85.0	74.7-88.0	**73.1-83.9**	75.4-87.0	76.40-90.8	76.2-90.0	77.5-90.0	75.30-88.6	72.80-81.90	66.4-74.7	72.1-82.3	**72.2-83.6**
TrAP (AC 2)	AEV [1][a]	80.7	82.8	82.0	**83.5**	82.8	82.0	82.0	82.0	79.8	83.5	82.8	82.8	58.9
	AYVY [1][a]	65.4	64.4	63.7	69.6	68.8	63.7	63.7	64.4	60.7	69.6	65.9	68.8	53.3
	BhVBhV [1][a]	64.9	74.6	74.0	68.6	68.6	74.0	74.0	74.6	70.6	70.6	80.6	70.0	54.0
	CaYMV [1][a]	61.0	62.9	63.7	65.9	66.6	63.7	63.7	62.9	60.0	65.1	67.4	66.6	52.5
	ChaYMV [1][a]	26.3	26.8	26.8	26.8	26.1	26.8	26.8	26.8	25.3	26.8	29.1	26.8	25.3
	ChiLCV [13][a]	59.5-75.5	**67.4-99.2**	**68.1-100.0**	63.7-79.1	63.7-79.1	**68.1-100.0**	**68.1-100.0**	**67.4-97.7**	**63.7-94.7**	62.9-79.1	69.60-83.50	63.7-79.1	54.0-57.4
	CLCuV [1][a]	97.0	67.0	74.0	10.4	89.0	74.0	74.0	67.0	59.0	97.0	89.00	97.0	59.0
	CYVMV [4][a]	64.4-75.5	72.3-83.5	71.6-82.8	67.1-79.8	67.1-79.8	71.6-82.8	71.6-82.8	72.3-83.5	68.6-79.1	**69.40-82.00**	80.50-94.00	68.6-81.3	51.4-61.9
	DLCV [1][a]	57.3	59.2	61.4	62.2	62.2	61.4	61.4	59.2	56.2	60.00	60.70	61.4	48.1
	MaLCuV [1][a]	65.4	71.1	71.1	71.1	70.3	71.1	71.1	69.6	66.6	70.30	70.30	71.8	54.8
	MYMIV [1][a]	48.1	45.5	47.0	52.2	51.4	47.0	47.0	45.5	43.3	51.40	47.70	50.7	43.3
	OELCuv [1][a]	56.9	54.6	56.0	62.6	62.6	56.0	56.0	54.6	52.6	60.00	56.00	60.6	48.0
	PaLCrV [15][a]	53.6-59.5	54.0-60.7	56.2-62.2	58.5-63.7	58.50-64.4	56.2-62.2	56.2-62.2	54.0-60.7	52.5-57.7	56.20-62.90	56.20-65.90	57.0-64.4	44.4-51.8
	PaLCuV [15][a]	**62.5-75.5**	62.2-91.7	63.7-94.0	65.9-81.3	**65.1-81.3**	63.7-94.0	63.7-94.0	62.0-91.0	58.5-87.3	65.90-81.30	**60.00-100**	**65.1-83.5**	47.7-61.9
	PeLCV [1][a]	68.1	76.8	77.6	71.6	69.4	77.6	77.6	76.1	73.1	71.60	79.80	70.8	54.4
	ToLCV [8][a]	53.3-77.0	56.7-88.8	55.9-88.0	58.9-79.8	57.4-79.1	55.9-88.0	55.9-88.0	55.9-88.0	55.2-84.3	58.90-79.80	59.70-89.50	59.7-79.1	**50.3-99.2**

REn (AC 3)	AEV [1][a]	82.2	74.6	75.3	85.8	85.0	76.1	76.1	71.4	68.6	84.30	82.80	84.3	64.7
	AYVY [1][a]	67.4	73.1	71.6	68.6	67.9	72.3	72.3	70.0	67.1	68.60	65.60	68.6	63.9
	BhVBhV [1][a]	83.7	74.6	73.8	87.3	84.3	74.6	74.6	71.4	69.4	84.30	87.30	84.3	63.9
	CaYMV [1][a]	64.4	66.4	65.6	67.9	65.6	66.4	66.4	63.5	61.1	67.90	64.1	67.9	60.2
	ChaYMV [1][a]	28.1	30.5	28.3	27.6	26.8	29.1	29.1	29.2	28.3	29.10	26.1	29.1	30.8
	ChiLCV [13][a]	43.6-78.5	**43.8-99.2**	**44.4-97.0**	45.0-82.0	44.4-78.3	**45.0-97.7**	**45.0-97.0**	**42.3-94.2**	**39.1-93.2**	45.0-79.1	49.7-79.8	45.0-79.1	39.7-67.6
	CLCuV [1][a]	76.2	70.1	69.4	79.1	77.6	69.4	69.4	67.1	64.9	79.1	76.1	79.1	63.9
	CYVMV [4][a]	79.2-90.3	73.8-76.8	71.6-76.8	81.3-93.2	80.5-90.2	72.3-77.6	72.3-77.6	70.7-73.5	67.9-70.8	79.80-90.2	79.8-92.5	79.8-91.0	64.7-66.1
	DLCV [1][a]	60.7	63.4	61.1	63.4	60.4	61.9	61.9	60.7	58.2	62.6	60.4	62.6	63.2
	MaLCuV [1][a]	57.7	67.9	67.1	60.4	58.2	67.9	67.9	64.2	61.9	59.7	61.1	59.7	64.7
	MYMIV [1][a]	41.4	40.2	40.2	43.2	40.2	41.0	41.0	38.5	38.0	41.7	41.0	41.7	40.4
	OELCuv [1][a]	71.1	68.6	67.9	73.1	71.6	68.6	68.6	66.4	64.1	70.8	67.9	70.8	66.1
	PaLCrV [15][a]	57.7-62.9	58.90-64.90	56.7-64.9	60.4-66.4	57.4-64.9	57.4-65.6	57.4-65.6	56.4-62.1	52.9-58.9	59.7-67.1	57.4-65.6	59.7-67.1	57.3-59.3
	PaLCuV [15][a]	**62.2-90.3**	67.9-94.7	65.6-91.0	**63.4-93.2**	**62.6-90.2**	66.4-91.7	66.4-91.7	65.0-90.0	61.9-88.8	**61.9-90.2**	**60.4-95.5**	**61.9-91.0**	62.5-67.6
	PeLCV [1][a]	72.5	72.3	70.1	75.3	73.1	70.8	70.8	69.2	66.4	75.3	76.1	75.3	66.9
	ToLCV [8][a]	61.3-83.7	64.7-77.6	62.5-78.3	61.70-86.5	59.5-84.3	63.2-79.1	63.2-79.1	61.9-74.2	60.2-71.6	61.0-85.0	61.7-87.3	61.0-85.0	**60.0-100.0**
AC4	AEV [1][a]	46.3	45.4	42.2	50.5	50.5	43.4	43.4	44.4	45.4	52.9	51.7	50.5	41.3
	AYVY [1][a]	47.4	43.4	40.2	52.9	52.9	41.4	41.4	42.4	43.4	40.0	41.1	40.0	37.9
	BhVBhV [1][a]	54.0	46.0	43.0	55.0	5.5	44.1	44.1	47.0	46.0	42.0	34.0	43.0	35.2
	CaYMV [1][a]	34.0	30.3	29.8	34.1	34.1	30.3	30.3	30.3	30.3	80.0	80.0	83.5	24.1
	ChaYMV [1][a]	25.7	22.2	23.7	28.2	28.2	23.2	23.2	22.2	22.2	34.1	34.1	34.1	18.3
	ChiLCV [13][a]	28.8-77.7	**30.3-98.9**	29.8-89.8	32.9-67.6	32.9-67.6	30.3-95.9	30.3-95.9	30.3-97.9	30.3-98.9	27.2-75.2	26.2-76.4	29.2-81.1	24.1-58.5
	CLCuV [1][a]	21.3	21.9	19.6	21.0	21.0	21.3	21.3	21.3	21.9	16.2	16.8	16.8	26.0
	CYVMV [3][a]	26.8-32.9	25.2-29.2	23.7-27.8	28.2-32.9	28.2-32.9	24.2-28.2	24.2-28.2	25.2-29.2	25.2-29.2	71.7-87.0	**76.4-88.2**	72.9-88.2	17.2-21.8
	DLCV [1][a]	45.3	38.3	39.1	38.2	38.2	40.4	40.4	38.3	38.3	67.0	65.9	69.1	27.0
	MaLCuV [1][a]	44.3	46.4	45.3	41.6	41.6	46.4	46.4	45.4	46.4	39.5	38.5	39.5	35.7
	MYMIV [1][a]	57.5	56.5	53.5	53.5	53.5	57.5	57.5	56.5	56.5	26.2	23.2	24.2	32.3
	OELCuv [1][a]	46.0	43.1	38.2	42.1	42.1	43.1	43.1	43.1	43.1	36.2	36.2	37.2	32.3
	PaLCrV [15][a]	43.0-48.0	43.1-50.0	40.0-48.0	40.1-44.0	40.1-44.0	42.1-50.0	42.1-50.0	42.1-49.0	43.1-50.0	34.3-40.0	34.3-40.0	33.3-40.0	36.2-39.2
	PaLCuV [13][a]	24.2-85.5	23.5-10	**20.7-90.9**	**24.2-77.3**	**24.2-77.3**	**22.1-96.9**	**22.1-96.9**	**23.5-98.9**	**23.5-100**	**28.2-96.4**	27.8-87.0	**30.0-96.4**	17.9-58.5
	PeLCV [1][a]	49.0	47.0	44.0	43.0	43.0	46.0	46.0	48.0	47.0	43.0	45.0	42.0	31.3
	ToLCV [8][a]	**38.1-89.6**	38.3-81.8	36.0-77.3	47.0-75.2	47.0-75.2	37.3-79.7	37.3-79.7	38.3-80.8	38.3-81.8	22.3-45.3	23.5-42.2	24.7-48.4	**32.1-65.0**

[a]Number of sequences from the databases used in the comparisons

For each gene the highest value is underlined and bold

AEV: Ageratum enation virus, AYVY: Ageratum yellow vein virus, BhVBhV: Bhendi yellow vein Bhubhaneswar virus, CaYMV: Catharanthus yellow mosaic virus, ChaYMV: Chayote yellow mosaic virus, ChiLCV: Chilli leaf curl virus, CLCuV: Cotton leaf curl, CYVMV: Croton yellow vein mosaic virus, DLCV: Duranta

leaf curl virus, MaLCuV: Malvastrum leaf curl virus, MYMIV: Mungbean yellow mosaic India virus, OELCuv: Okra enation leaf curl virus, PaLCrV: Papaya leaf crumple virus, PaLCuV: Papaya leaf curl virus, PeLCV: Pedilanthus leaf curl virus, ToLCV: Tomato leaf curl virus

Table S6. Recombination analysis of breakpoint and its putative parental sequences of begomoviruses isolated from papaya.

Begomovirus	Break point (nt)			Recombination parents		p-value					
	Events	Begin	End	Major parent	Minor parent	RDP	Geneconv	MaxChi	Chimera	SiScan	3Seq
PLC -1 (PaLCuBKV :OL630090)	1	40	2148	ToLCKV-[IN:Kar:Ben:Chi:08].HM007094	PaLCuV-[IN:Kar:Kal:Pap:21] OL677450	2.702×10^{-10}	NS	7.363×10^{-21}	1.682×10^{-11}	3.720×10^{-29}	8.168×10^{-57}
	2	2262	2440	CLCuBuV-[IN:LK_2N:Pap:11].KX302707	OELCuV-[IR:BK:IRP72010:Pap:10] KJ397529	NS *	1.534×10^{-2}	2.646×10^{-2}	9.615×10^{-3}	1.455×10^{-7}	NS
	3	282	1175	ChiLCV-[IN:Kar:Bgk:Pap:21] OL677446	PaLCrV-[IN:Haj:B23N:Pap:11] KX302710	5.543×10^{-3}	NS	1.510×10^{-6}	7.523×10^{-9}	8.680×10^{-6}	1.096×10^{-2}
	4	1339	2070	CYVMV-[IN:HR:Acl:07].FN645901	ChiLCV-[IN:Kar:Bel:Pap:21] OL677445	9.624×10^{-4}	2.182×10^{-9}	9.177×10^{-4}	2.534×10^{-7}	1.291×10^{-11}	1.090×10^{-8}
PLC -2 (ChiLCV :OL630091)	1	1907	2019	ChiLCV-DU[IN:ND:DU:Pap:09] HM140364	AYVV-[CN:Sanya:Pap:13] KM051844	7.740×10^{-13}	2.037×10^{-2}	2.936×10^{-4}	3.688×10^{-2}	NS	4.868×10^{-2}
	2	2250	2433	PaLCuV-[IN:Raj:DP2:Pap:15] KX353622	PaLCrV-[PK:Lah:KN6:Pap:11] HE580236	1.893×10^{-3}	NS	4.571×10^{-5}	1.875×10^{-3}	5.966×10^{-7}	6.564×10^{-3}
PLC -3 (ChiLCV:	1	2241	2433	PaLCuV-[IN:Raj:DP2:Pap:15] KX353622	PaLCrV-[PK:Lah:KN6:Pap:11]	1.893×10^{-3}	NS	4.517×10^{-5}	1.875×10^{-3}	5.966×10^{-7}	6.564×10^{-3}

OL677445)					HE580236						
PLC -4 (	1	1272	2158	CYVMV-[IN: HR: Acl: 07]. FN645901	ChiLCV-[IN:Kar:Bel:Pap:21] OL677445	9.624×10^{-4}	2.182×10^{-9}	9.177×10^{-4}	2.534×10^{-7}	1.291×10^{-11}	1.090×10^{-8}
	2	11	2185	PaLCuV-[CH:Gua:G2:Pap:04] AJ558123	CYVMV-[IN:Pun:Acl:07] FN645926	8.115×10^{-16}	8.946×10^{-27}	2.130×10^{-22}	1.040×10^{-27}	4.436×10^{-39}	9.474×10^{-37}
	3	2696	2785	BhVBhV-[IN:OD;Bhu:Ok:03] FJ589571	PaLCrV-[IN:ND:Cro:08] JN817517	5.844×10^{-6}	4.486×10^{-5}	8.898×10^{-3}	NS	NS	NS
	4	294	1174	PaLCuV-[IN:ND:Rad:18] FJ593629	PaLCrV-[IN:Haj:B23N:Pap:11] KX302710	5.543×10^{-3}	NS	1.510×10^{-6}	7.523×10^{-9}	8.680×10^{-6}	1.096×10^{-2}
	5	2408	2834	PaLCuBKV-[IN:Kar:Bgk:Pap:21] OL677443	ChiLCV-[IN:Kar:Rai:Chi:17] PaLCuBKV :OL677443)MK161454	6.983×10^{-3}	NS	3.204×10^{-5}	6.595×10^{-04}	3.089×10^{-4}	1.835×10^{-3}
	6	2508	2941	PaLCuBKV-[IN:Kar:Bel:Pap:21] OL630090	BhVBhV-[IN:OD;Bhu:Ok:03] FJ589571	6.310×10^{-6}	7.023×10^{-5}	4.530×10^{-9}	8.036×10^{-9}	3.340×10^{-10}	1.932×10^{-17}
PLC -7 (PaLCuBKV :OL677444)	1	1273	2158	CYVMV-[IN:HR:Acl:07] FN645901	ChiLCV-[IN:Kar:Bel:Pap:21] OL677445	9.624×10^{-4}	2.182×10^{-9}	9.177×10^{-4}	2.534×10^{-11}	1.291×10^{-11}	1.090×10^{-8}
	2	282	1174	ChiLCV-[IN:Kar:Bgk:Pap:21] OL677446	PaLCrV-[IN:Haj:B23N:Pap:11] KX302710	5.543×10^{-3}	NS	1.510×10^{-6}	7.523×10^{-9}	8.680×10^{-6}	1.096×10^{-2}
	3	2486	2941	PaLCuBKV-[IN:Kar:Bel:Pap:21] OL630090	BhVBhV-[IN:OD;Bhu:Ok:03] FJ589571	6.310×10^{-6}	7.023×10^{-5}	4.530×10^{-9}	8.036×10^{-9}	3.340×10^{-10}	1.932×10^{-17}
PLC -9 (ChiLCV: OL677446)	1	2251	2453	PaLCuV-[IN:Raj:DP2:Pap:15] KX353622	PaLCrV-[PK:Lah:KN6:Pap:11] HE580236	1.893×10^{-3}	NS	4.571×10^{-5}	1.875×10^{-3}	5.966×10^{-7}	6.564×10^{-3}
PLC -11 (ChiLCV: OL677447)	1	2251	2453	PaLCuV-[IN:Raj:DP2:Pap:15] KX353622	PaLCrV-[PK:Lah:KN6:Pap:11] HE580236	1.893×10^{-3}	NS	4.571×10^{-5}	1.875×10^{-3}	5.966×10^{-7}	6.564×10^{-3}
PLC -18 (ChiLCV: OL677448)	1	362	1363	ChiLCV-[IN:Kar:Rai:Chi:17] MK161454	ChiLCV-[IN:Kar:Bel:Pap:21] OL677445	NS	NS	3.368×10^{-2}	1.898×10^{-3}	NS	NS
	2	2250	2433	PaLCuV-[IN:Raj:DP2:Pap:15]	PaLCrV-	1.893×10^{-3}	NS	4.571×10^{-5}	1.875×10^{-3}	5.966×10^{-7}	6.564×10^{-3}

				KX353622	[PK:Lah:KN6:Pap:11] HE580236						
PLC -22 (ChiLCV: OL677449)	1	550	1074	ChiLCVN-[IN:UP:Noi:Pap:09] HM140371	CYVMV-[IN:Kar:Kal:Pap:21] OL677451	4.860×10^{-63}	3.671×10^{-58}	1.179×10^{-20}	5.644×10^{-21}	3.778×10^{-16}	6.621×10^{-12}
	2	2250	2433	PaLCuV-[IN:Raj:DP2:Pap:15] KX353622	PaLCrV-[PK:Lah:KN6:Pap:11] HE580236	1.893×10^{-3}	NS	4.571×10^{-5}	1.875×10^{-3}	5.966×10^{-7}	6.564×10^{-3}
PLC -25 (PaLCuV :OL677450)	1	520	1246	ToLCKV-[IN:Kar:Ben:Chi:08] HM007094	CYVMV-[IN:Pun:Acl:07] FN645926	3.857×10^{-8}	1.194×10^{-14}	2.228×10^{-7}	2.651×10^{-5}	1.698×10^{-33}	2.521×10^{-26}
	2	2241	28	PaLCrV-Nirulas[IN:ND:Pap:07] HM140368	PaLCuV-[IN:Raj:DP2:Pap:15] KX353622	4.539×10^{-3}	NS	3.218×10^{-5}	1.893×10^{-6}	1.291×10^{-7}	1.140×10^{-3}
	3	1268	2249	CYVMV-[IN:HR:Acl:07] FN645901	ChiLCV-[IN:Kar:Bel:Pap:21] OL677445	9.624×10^{-4}	2.182×10^{-9}	9.177×10^{-4}	2.534×10^{-7}	1.291×10^{-11}	1.090×10^{-8}
	4	2702	2863	ChiLCV-[IN:Kar:Rai:Chi:17] MK161454	PaLCuBKV-[IN:Kar:Bel:Pap:21] OL630090	6.983×10^{-3}	NS	3.204×10^{-5}	6.595×10^{-4}	3.089×10^{-4}	1.835×10^{-3}
	5	282	1178	ChiLCV-[IN:Kar:Bgk:Pap:21] OL677446	PaLCrV-[IN:Haj:B2_3N:Pap:11] KX302710	5.543×10^{-3}	NS	1.510×10^{-6}	7.523×10^{-9}	8.680×10^{-6}	1.096×10^{-2}
PLC -28 (CYVMV OL677451)	1	284	1227	ChiLCV-[IN:Kar:Bgk:Pap:21] OL677446	PaLCrV-[IN:Haj:B2_3N:Pap:11] KX302710	5.543×10^{-3}	NS	1.510×10^{-6}	7.523×10^{-9}	8.680×10^{-6}	1.096×10^{-2}
	2	1916	2237	ChiLCV-[IN:Kar:Bgk:Pap:21] OL677447	PaLCuGdV-[CH:Gua:GD2:Pap:04] NC_005844	NS	NS	NS	2.474×10^{-1}	3.534×10^{-13}	NS
	3	2255	2894	PaLCuV-[IN:Raj:DP2:Pap:15] KX353622	PaLCrV- [IN:ND:Pap:07] HM140368	4.539×10^{-3}	NS	3.218×10^{-5}	1.893×10^{-6}	1.291×10^{-7}	1.140×10^{-3}
	4	2392	2884	PaLCrV-[IN:Bho:PSB-66:Pap:16] MH807203	ChiLCV-[IN:ND:DU:Pap:09] HM140364	9.495×10^{-8}	2.999×10^{-5}	2.996×10^{-3}	1.190×10^{-6}	1.704×10^{-12}	$4.864.10^{-5}$
	5	1079	1226	PaLCuV-[IN:Kar:Madi:Cal:18] MK087120	PaLCuBKV-[IN:Kar:Bgk:Pap:21] OL677443	NS	6.970×10^{-18}	1.050×10^{-10}	1.595×10^{-10}	7.464×10^{-14}	5.281×10^{-22}
PLC -31	1	1268	2182	CYVMV-[IN:HR:Acl:07]	ChiLCV-	9.624×10^{-4}	2.182×10^{-9}	9.177×10^{-4}	2.534×10^{-7}	1.291×10^{-11}	1.090×10^{-8}

(PaLCuV :OL677452)				FN645901	[IN:Kar:Bel:Pap:21] OL677445						
	2	2836	2914	ToLCKV-[IN:GJ:AHM:Tom:16] MH5770301	PeLCV-[IN:Guj:Amd:PSB37:Pap:15] MH765695	NS	4.820×10^{-2}	1.992×10^{-2}	NS	1.298×10^{-6}	2.476×10^{-2}
	3	2240	2513	PaLCrV-Nirulas[IN:ND:Pap:07] HM140368	PaLCuV-[IN:Raj:DP2:Pap:15] KX353622	4.539×10^{-3}	NS	3.218×10^{-5}	1.893×10^{-6}	1.291×10^{-7}	1.140×10^{-3}
	4	11	2513	ToLCKV-[IN:Kar:Ben:Chi:08 HM007094	CYVMV-[IN:Pun:Acl:07] FN645926	3.857×10^{-8}	1.194×10^{-14}	2.338×10^{-7}	2.651×10^{-5}	1.698×10^{-33}	2.521×10^{-26}
	5	235	1178	ChiLCV-[IN:Kar:Bgk:Pap:21] OL677446	PaLCrV-[IN:Haj:B23N:Pap:11] KX302710	5.543×10^{-3}	NS	1.510×10^{-6}	7.523×10^{-9}	8.680×10^{-6}	1.096×10^{-2}
	6	2540	2613	PaLCuV-[IN:Guj:Jam:PSB-34:Pap:15] MH807205	ToLCKV-[IN:Kar:Ben:Chi:08] HM007094	NS	NS	2.164×10^{-2}	NS	2.884×10^{-7}	9.162×10^{-3}
PLC -32 (PaLCuHV :OL677453)	1	218	992	ToLCV-[In:Kar:Ben:Chr:17] MG758145	ChiLCV-[IN:Kar:Bel:Pap:21] OL630091	5.828×10^{-33}	7.920×10^{-10}	3.819×10^{-23}	1.461×10^{-21}	1.329×10^{-20}	1.622×10^{-16}
	2	2178	2729	PaLCuV-[IN:TN:Wel:WB2&5Pap:10] KX302713	ChiLCV-[IN:Kar:Kal:Pap:21] OL677448	1.053×10^{-31}	3.869×10^{-38}	7.021×10^{-18}	1.121×10^{-23}	2.285×10^{-30}	6.621×10^{-12}
	3	1190	2862	PaLCrV-[IN:Jab:PSB-32:Pap:11] MH674437	ChiLCV-HD[IN:ND:HD:Pap:07] HM140365	4.051×10^{-2}	NS	1.296×10^{-2}	4.714×10^{-4}	NS	2.030×10^{-4}
	4	1200	1166	PaLCrV-Panipat8[IN:Har:Pan:Pap:08] NC_014707	CYVMV-[IN:Kar:Kal:Pap:21] OL677451	NS	NS	1.620×10^{-2}	8.354×10^{-6}	8.499×10^{-6}	1.712×10^{-19}

NS: Non significant value

Reference

Rojas, M.R.; Gilbertson, R.L.; Maxwell, D.P. Use of degenerate primers in the polymerase chain reaction to detect whitefly-transmitted geminiviruses. *Plant Dis.* **1993**, *77*, 340–347.