

Table S1 List of primers used in this study

Primer name	Primer sequence (5'-3')	Annealing temperature (°C)	Product size and notices	Reference
Primers used for detecting <i>Ty-1</i> , <i>Ty-3</i> , and <i>Ty-3a</i>				Koeda and Kitawaki. 2024
SK-F1 SK-R1	GGGTGATCCGTTGATTGAAG CCTGCTCCTTGCAGATTCTA	55	Indel marker detecting 12 bp insertion specific to <i>Ty-1</i> , <i>Ty-3</i> , and <i>Ty-3a</i> on 1st exon of RDR Susceptible: 92 bp, <i>Ty-1</i> , <i>Ty-3</i> , <i>Ty-3a</i> : 104 bp	
SK-F3 SK-R4	CAAGTATCTGGCGTGTTTTG TTACGGTTTATGGAACCCAAT	55	CAPs marker detecting <i>Ty-1</i> , <i>Ty-3</i> , and <i>Ty-3a</i> specific SNP on 14th exon of RDR Digestion with <i>AfaI</i> (GTAC) Susceptible: 159 bp, <i>Ty-1</i> , <i>Ty-3</i> , <i>Ty-3a</i> : 215 bp	
SK-F1 SK-R2	GGGTGATCCGTTGATTGAAG GGGCTAGAGGAAGAGGAGAGAC	55	Indel and CAPs marker detecting 12 bp insertion and <i>Ty-3a</i> specific SNP on 1st exon of RDR Digestion with <i>ClaI</i> (ATCGAT) Susceptible: 264 bp, <i>Ty-1</i> , <i>Ty-3</i> : 276 bp, <i>Ty-3a</i> : 238 bp	
SK-F2 SK-R3	TGTATAAAGATGATAAAGAGAGGAAGAAAAGTC CCATCATYGCAGGTTCCCAT	55	dCAPs marker detecting <i>Ty-3</i> specific SNP on 6th exon of RDR Digestion with <i>NcoI</i> (CCATGG) Susceptible, <i>Ty-1</i> , <i>Ty-3a</i> : 96 bp, <i>Ty-3</i> : 113 bp	
SK-F4 SK-R5	TTGGTAGATTCTTATACAACAAGTAGAC ACTTTGCTTCCAGAAATTTCTT	55	dCAPs marker detecting <i>Ty-1</i> specific SNP on 15th exon of RDR Digestion with <i>Hpy188III</i> (TCNNGA) Susceptible, <i>Ty-3</i> , <i>Ty-3a</i> : 136 bp, <i>Ty-1</i> : 106 bp	
Primers used for detecting <i>Ty-2</i> and <i>η-2</i>				Yamaguchi et al. 2018
<i>Ty-2</i> F (original name 1382) <i>Ty-2</i> R (original name 1401)	GGAGGTTGTCGTTGCAATTGGTGATGT CCTTGTCCACCAGTGACGAAGGT	68	Dominant marker detecting <i>Ty-2</i>	
<i>ty-2</i> F (original name 1433) <i>ty-2</i> R (original name 1436)	GGTTGGCTTAGCAGTTGGTGTGCA GAGCATCATCAAAAAGAGATGTAT	55	Dominant marker detecting <i>η-2</i>	
Primers used for detecting <i>η-5</i>				This study
<i>ty-5</i> F <i>ty-5</i> R	GTAGAGACTTTGTTCTCTGATGGTTCTGGCCATG ATTGCTAATAATGCTAAGCCCTCA	55	dCAPs marker detecting <i>ty-5</i> Digestion with <i>NcoI</i> (CCATGG) <i>Ty-5</i> : 312 bp, <i>η-5</i> : 31 + 281 bp	
Primers used for detecting <i>Ty-6</i>				Shen et al. 2025 and this study
<i>Ty-6</i> 2F <i>Ty-6</i> R	GATTGTGTGCTGAGTGTGCTT TCCTTTGCTTCGCCTTCCTTA	60	CAPs marker detecting <i>Ty-6</i> Digestion with <i>AanI</i> (Psil) (TTATAA) <i>η-6</i> : 567 + 223 bp, <i>Ty-6</i> : 790 bp	
Primer used for viral DNA detection				
PepYLCIV V2UniF PepYLCIV V2UniR PepYLCIV A6-E2 UniR	GTGYWGTAYCTTCTGYGGAAYTKGA GAACTTCAAGCGTGGGTGTC ACGCCGTAACGATGTTTAYGCG	58	For detecting PepYLCIV and PepYLCaV For detecting PepYLCaV For detecting PepYLCIV	Kesumawati et al. 2019
TYLCKaV uni F TYLCKaV uni R	TACATAATCAGTCGCGCTATTACA CATAGGAATKGTATTGAAGTGGAATCT	65	For detecting TYLCKaV 831 bp	Kesumawati et al. 2020
Primer used for quantification of begomoviral DNA				
IV AV Real F IV AV Real R	GCTTTCCTCAGGTTGTGGTTG TCCCCTCTATTCAAGGTGCTG	58	For detecting PepYLCIV and PepYLCaV 102 bp	Koeda et al. 2021
TYLCKaV A Real 2F TYLCKaV A Real 2R	ATGACTGCTTTTGTAGTGCCGGTA TGGTCCCACATGTACTGCTGA	58	For detecting TYLCKaV 80 bp	Koeda et al. 2020
25S rRNA 2F 25S rRNA 2R	GCCCCGTCGTACTCATAACC GATCCATTTTGCCGACTTCC	58	For quantifying the tomato genomic DNA 93 bp	Koeda et al. 2020