

Appendix A Information of different *Helianthus annuus* varieties

No.	Seed lists	Country of origin	Import company
1	X3907	Netherland	Beijing Golden Grain-rain Seeds LTD
2	X3939	Netherland	Beijing Golden Grain-rain Seeds LTD
3	FFH702	Netherland	Beijing Golden Grain-rain Seeds LTD
4	A231	The United States	Beijing Sanrui Agricultural Science LTD
5	SH1220	The United States	Beijing Sanrui Agricultural Science LTD
6	SH1108	The United States	Beijing Sanrui Agricultural Science LTD
7	SR1320	The United States	Beijing Sanrui Agricultural Science LTD

Appendix B Primer sequences used in this study

Primer name	Primer sequence (5'-3')	Primer position	size (bp)	Purpose
E1-F	CAGGAATGGGACAGATTCGAC	13416-13463	1188	HaEV detection
E1-R	CCAGGTGTGTGTTTTGAGGTC	14583-14603		
E2-F	GCACCAAGACGGGAAGATAGTC	3896-3917	1056	HaEV detection
E2-R	CCGTATCCCACTATGTTCTTGC	4930-4951		
1-2 F	CAAGGACTGTAGCCCTTGCG	2507-2526	164	gap between contigs
1-2 R	GTTGTCCTACCATGTCAGCG	2651-2670		
2-3 F	CAACAGTTCCTGCACCTAGC	6252-6271	229	gap between contigs
2-3 R	CATTGATCTTGACCTGGCTG	6460-6480		
3-4 F	CCCAGCGGAGGATAGCTGAC	7774-7793	577	gap between contigs
3-4 R	AAGTCCCACCGCCTTGCTGC	8331-8350		
4-5 F	CACAGAAGCAACCCGACCAG	10262-10281	1838	gap between contigs
4-5 R	CCTCATTAGTGGGTGGTCTTAG	12078-12099		
1-5'-GSP1	CGAAACCGCCGAATAG	1221-1236	—	viral RNA 5' terminus
1-5'-GSP2	GGGTGTATGCTTCATCTATCTCG	1076-1098		
1-5'-GSP3	TGGTGTTCGGTTTCCTGTGGC	811-830		
2-5'-GSP1	CGTTTGGGTTGATAGAC	1010-1026	—	viral RNA 5' terminus
2-5'-GSP2	TCTGGTGTTCGGTTTCCTGTGGC	811-832		
2-5'-GSP3	TTAGCCAGAGGTTCAACAGTTC	781-802		
3-5'-GSP1	CTACTTTGGACCGTTG	444-459	—	viral RNA 5' terminus
3-5'-GSP2	TGTTCTCGGTCAAGCGTCGTG	184-204		
3-5'-GSP3	GCGTGTGTATTGAAGAGGGTT	58-79		
1-3'-GSP2	TTACCACAACCCACAAGGAGT	14279-14299	—	viral RNA 3' terminus
1-3'-GSP3	ACGAGGTGACAAATGGAGTAAG	14341-14362		
2-3'-GSP2	TGATAGGGAAAACAATGGGAACC	14413-14435		
probe	GCTTGTCCGGTGAGTCTCATGCCGG TCAATAT	14019-14050	—	FISH detection

A**B**

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ACCGTTGCT TTGGACCAC GCGCTAATG AGTGGCCATA AGGATGTCG GTTTCGTTCT AATTTTCGGT ATGATTCGC CTTTCAGGC ATACGTCGC
13801 GACTAACACA AGAGGAGTTA TCTTCRAGG TTAATCTTAT ACATGGCGAC TGTGGTTTA TGGAGGATGA CCTGAGCAAA CAAGATAGAC AAACGGACAT
CTGATTTGTT TCTCCTCAAT AGAAGTTCCC AATTAGATA TGTACCGCTG ACACCCAAAT ACCTCCTACT GGACTCGTTT GTTCTATCTG TTTCCTGTGA
13901 TAACTGATA CAATGTGAAA TGTATATATA CTCACAACTA GGGTAGCAG ATGACGTGCT GAACCTATGG AGACGACAC ACGAAACTG GAAATTCAGA
ATTAGACTAT GTTACACTTT ACAATATATA GAGTGTGAT CCCCATCGTC TACTGCACGA CTTGAATACC TCTGCTTGTG TGCCTTTGAC CTTTAACTCT
14001 GGAACAAATG TGTGGGGAT ATTGACCGGC ATGAGACTCA CCGGACAGCC CACTACAGCA GTAGGCACCG CCATAGTCAA CTGTATAGTA CACAGCAGGA
CCTTGTTCAC ACAGCCCCA TAACTGSCCG TACTCTGAGT GGCCTGTTCC GTGATGTGTT CATCCGTTGC GGTATCAGTT GAACAATCAT GTTCTGCTCT
                                                                C#
14101 TTTTGGAAAC CAACRAGAT CATATTGAGT TAATGCTATT ACTAGGGGAC GACRATCTTG TTATAGCAG AAACCGAATC GATAGCTCGA AGCAGTCAA
AAAAGCTTTG GTTGTCTTA GTATACTCA ATTACGATAA TGATCCCTTG CTGTTAGAAC AATAHTCGTC TTGGCTTAG CTATCGAGCT TCGTCAGTTT
14201 AATAAGCAA GATTATTACA ACATGGTCAG CAAGGCCAGT CAGATAGAG ACCAAGGAC ATTCCITCAA TTATTATGTT ACCACRACC ACAAGGAGTA
TTATTCGTTT CTAATAATGT TGTACCAGTC GTTCGGTCA GTGCTATCTC TGGTTCCTTG TAAGGAGTT AATAATACAA TGGTGTGGG TGTTCCTCAT
14301 CTGGAGTTTG GCCCAGAGT AATCAGACTA GCACAAAGT ACGAGGTGAC AAATGGAGTA AGTGAAGTGA ACATACAAA CATGTTGCT AGACGATGA

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Appendix C FISH experiment. (A) HaEV-infected leaves (1 × 1 cm) were pre-chilled in chemical fixatives FAA (75% ethanol, 5% acetic acid and 5% formalin). (B) The probe was complementary to the genome 14019-14050 nt.