

Supplementary Table S1. Turnip mosaic virus isolates analysed in this study--

Isolate	Original host	Location (City, District, Country)	Year of collection	Host type ^a	Reference	Accession code
Oceania						
Australia						
AU1	<i>Hirschfeldia incana</i>	Canberra, ACT	1998	B		This study
AUST1 (3696F#11)	<i>Cicer arietinum</i>	Myall Vale-Narrabri, NSW	2003	B	Schwinghamer <i>et al.</i> (2014)	This study
AUST2 (3834A#5)	<i>Rapistrum rugosum</i>	Breeza, NSW	2004	B(R)	Schwinghamer <i>et al.</i> (2014)	This study
AUST3 (3896A#3)	<i>Brassica Juncea</i>	Breeza, NSW	2004	B	Schwinghamer <i>et al.</i> (2014)	This study
AUST4 (3896B#4)	<i>B. Juncea</i>	Breeza, NSW	2004	B(R)	Schwinghamer <i>et al.</i> (2014)	This study
AUST6 (Q1280#6)	<i>R. rugosum</i>	Allora, QLD	2001	B	Schwinghamer <i>et al.</i> (2014)	This study
AUST10 (Q186)	<i>B. pekinensis</i>	Kalbar, QLD	1996	B		This study
AUST13 (Q484)	<i>B. pekinensis</i>	Gatton, QLD	1994	B		This study
AUST19 (Q2080)	<i>Raphanus</i> <i>R.</i> <i>raphanistrum</i>	Melbourne, VIC	2007	B(R)		This study
AUST21 (5346A#1)	<i>H. incana</i>	Tamworth, NSW	2011	B		This study
AUST22 (5349A#1)	<i>R. rugosum</i>	Tamworth, NSW	2011	B		This study
AUST23 (Q2081)	<i>R. raphanistrum</i>	Melbourne, VIC	2007	B(R)		This study
AUST26 (4323A#1)	<i>B. rapa</i>	Mullaley, NSW	2007	B		This study
AUST27 (4323C#1)	<i>B. rapa</i>	Mullaley, NSW	2007	B		This study
AUST28 (5346B#1)	<i>H. incana</i>	Tamworth, NSW	2011	B		This study
AUST29 (5349B#1)	<i>R. rugosum</i>	Tamworth, NSW	2011	B		This study
BR51	<i>B. rapa</i>	Brisbane, NSW	2007	Not known		HMS44042
New Zealand						
NZ11	<i>Crocus sativus</i>	Mid Canterbury-South Island	2002	ND	Ochoa Corona <i>et al.</i> (2007)	This study
NZ12	<i>Nasturtium officinale</i>	Kumeu, Auckland-North Island	2003	ND	Ochoa Corona <i>et al.</i> (2007)	This study
NZ246	<i>B. napus</i> cv. York Globe	Hornby, Mid Canterbury-South Island	1995	B		This study
NZ290	<i>B. pekinensis</i>	Hornby, Mid Canterbury-South Island	1998	B	Tomimura <i>et al.</i> (2003)	AB093612
NZ402	<i>Lepidium oleraceum</i>	Stony Bay ,Banks Peninsula, South Island	2010	B		This study
NZ403	<i>L. oleraceum</i>	Island Rock, Banks Peninsula, South Island	2010	B		This study
NZ403B	<i>L. oleraceum</i>	Island Rock Banks Peninsula, South Island	2010	B		This study
NZ412	<i>Pachycladon fastigiatum</i>	Lincoln, Mid Canterbury-South Island	2010	B	Fletcher <i>et al.</i> (2010)	This study
NZ412B	<i>P. fastigiatum</i>	Lincoln, Mid Canterbury-South Island	2010	B	Fletcher <i>et al.</i> (2010)	This study
NZ415	<i>L. oleraceum</i>	Bridge Point,Otago,South Island	2010	B		This study
NZ419	<i>B. rapa</i> cv. Marco	Methven, Mid Canterbury-South Island	2010	B		This study
NZ419B	<i>B. rapa</i> cv. Marco	Methven, Mid Canterbury-South Island	2010	B		This study
NZ419C	<i>B. rapa</i> cv. Marco	Methven, Mid Canterbury-South Island	2010	B		This study
NZL5 (NZ298)	<i>Brassica</i> spp.	Lincoln, Canterbury-South Island	1999	B		This study
NZW3 (NZ299)	<i>B. rapa</i>	Lincoln, Mid-Canterbury-South Island	1999	B		This study
NZW4 (NZ300)	<i>B. rapa</i>	Lincoln, Mid-Canterbury-South Island	1999	B		This study
NZW6 (NZ302)	<i>B. rapa</i>	Lincoln, Mid-Canterbury-South Island	1999	B		This study
Asia						
IJ	<i>Raphanus. sativus</i>	Saga, Saga, Japan	1977	BR	Ohshima <i>et al.</i> (1996)	D83184
ZJ	<i>B. pekinensis</i>	-, Tochigi, Japan	1994	BR	Tomimura <i>et al.</i> (2003)	AB093622
9J	<i>R. sativus</i>	Saga, Saga, Japan	1996	BR	Tomimura <i>et al.</i> (2003)	AB093620
AD178J	<i>R. sativus</i>	Rokunohe, Aomori, Japan	1998	BR	Ohshima <i>et al.</i> (2007)	AB252094
AD181J	<i>R. sativus</i>	Tohoku, Aomori, Japan	1998	BR	Ohshima <i>et al.</i> (2007)	AB252095
AD853J	<i>R. sativus</i>	Ohhata, Aomori, Japan	2002	BR	Ohshima <i>et al.</i> (2007)	AB252096
AD855J	<i>R. sativus</i>	Ohminato, Aomori, Japan	2002	BR	Ohshima <i>et al.</i> (2007)	AB252097
AD860J	<i>R. sativus</i>	Sennai, Aomori, Japan	2002	BR	Ohshima <i>et al.</i> (2007)	AB252098
AKD161J	<i>R. sativus</i>	Ogachi, Akita, Japan	1998	BR	Ohshima <i>et al.</i> (2007)	AB252099
AKD934J	<i>R. sativus</i>	Hachiryu, Akita, Japan	2000	BR	Ohshima <i>et al.</i> (2007)	AB252100
AKH937J	<i>B. pekinensis</i>	Yuzawa, Akita, Japan	2000	BR	Ohshima <i>et al.</i> (2007)	AB252101
AT181J	<i>Eustoma russellianum</i>	Aomori, Aomori, Japan	<1998	BR	Ohshima <i>et al.</i> (2007)	AB252102
BJ-B01	<i>B. oleracea</i>	Beijing, Beijing, China	2010	Not known		KC119185
BJ-B02	<i>B. oleracea</i>	Beijing, Beijing, China	2010	Not known		KC119186
BJ-B03	<i>B. oleracea</i>	Beijing, Beijing, China	2010	Not known		KC119187
BJ-B04	<i>B. oleracea</i>	Beijing, Beijing, China	2009	Not known		KC119188
BJ-B05	<i>B. oleracea</i>	Beijing, Beijing, China	2009	Not known		KC119189
BJ-C4	<i>B. oleracea</i>	Beijing, Beijing, China	1985-1987	Not known		HQ446217
BJ-R01	<i>R. sativus</i>	Beijing, Beijing, China	2010	Not known		KC119184
C1	Not known	-, Taiwan	Not known	Not known		AF394601
C42J	<i>B. rapa</i>	Saga, Saga, Japan	1993	B	Tomimura <i>et al.</i> (2003)	AB093625
CH6	<i>R. sativus</i>	Zengjiang, Jiangsu, China	1999	BR	Ohshima <i>et al.</i> (2007)	AB252103
CHK16	<i>R. sativus</i>	Gulin, Guangxi, China	2000	BR	Ohshima <i>et al.</i> (2007)	AB252104
CHL13	<i>R. sativus</i>	Lushun, Liaoning, China	1999	BR	Ohshima <i>et al.</i> (2007)	AB252105
CHN 1	<i>Brassica</i> sp.	-, -, Taiwan	<1980	BR	Tomimura <i>et al.</i> (2003)	AB093626
CHN 12	Not known	-, -, China	<1990	B	Jenner <i>et al.</i> (2002)	AY090660
CHZJ26A	<i>B. campestris</i>	Jiande, Zhejiang, China	1999	B(R)	Ohshima <i>et al.</i> (2007)	AB252106
CP845J	<i>Calendula. officinalis</i>	Kisarazu, Chiba, Japan	1997	BR	Tomimura <i>et al.</i> (2003)	AB093614
DMJ	<i>R. sativus</i>	-, Tochigi, Japan	1996	BR	Tomimura <i>et al.</i> (2003)	AB093623
FD27J	<i>R. sativus</i>	Fukuoka, Fukuoka, Japan	1998	BR	Tomimura <i>et al.</i> (2003)	AB093618
FKD001J	<i>R. sativus</i>	Sukagawa, Fukushima, Japan	2000	BR	Ohshima <i>et al.</i> (2007)	AB252109
FKD004J	<i>R. sativus</i>	Funehiki, Fukushima, Japan	2000	BR	Ohshima <i>et al.</i> (2007)	AB252110
FKH122J	<i>B. pekinensis</i>	Naraha, Fukushima, Japan	1998	BR	Ohshima <i>et al.</i> (2007)	AB252111
GFD462J	<i>R. sativus</i>	Yoro, Gifu, Japan	2001	BR	Ohshima <i>et al.</i> (2007)	AB252115
H1J	<i>R. sativus</i>	Hirosaki, Aomori, Japan	1996	BR	Ohshima <i>et al.</i> (2007)	AB252118
HOD517J	<i>R. sativus</i>	Kimobetsu, Hokkaido, Japan	1998	BR	Tomimura <i>et al.</i> (2003)	AB093617
HRD	<i>R. sativus</i>	Hongzhou, Zhejiang, China	1998	BR	Tomimura <i>et al.</i> (2003)	AB093627
H26	<i>Brassica</i> sp.	Xiaoshan, Zhejiang, China	1998	B	Ohshima <i>et al.</i> (2007)	AB252119

^aHost type B; *Brassica*, isolates infected *B. rapa* cv. Hakatasuwari systemically giving mosaic symptoms. Host type (B); isolates infected *B. rapa* only occasionally. Host type BR; these isolates infected both *B. rapa* and *R. sativus* systemically giving mosaic symptoms. Host type B(R); isolates infected *B. rapa* systemically giving mosaic symptoms and infected *R. sativus* only occasionally.

Formatted: Indent: Left -2.03 ch, First line: 0 ch

Formatted Table

Formatted: Font: 8 pt, Italic

Formatted: Indent: First line: 0.05 ch

Formatted: Font: 8 pt

Formatted: Indent: First line: 0.05 ch

Formatted: Font: 8 pt

Formatted: Indent: First line: 0.05 ch

Formatted: Font: 8 pt

Formatted: Indent: First line: 0.05 ch

Formatted: Indent: Hanging: 0 cm, Left -2.02 ch, Right -0.05 ch

^hDifficult to infect brassica plants
^cUnclear

Supplementary Table S1. Continued

isolate	Original host	Location (City, District, Country)	Year of collection	Host type	Reference	Accession code
Asia						
WD032J	<i>R. sativus</i>	Iwaizumi, Iwate, Japan	2000	BR	Ohshima <i>et al.</i> (2007)	AB252120
WD038J	<i>R. sativus</i>	Yahaba, Iwate, Japan	2000	BR	Ohshima <i>et al.</i> (2007)	AB252121
Ka1J	<i>B. pekinensis</i>	-, Tochigi, Japan	1994	BR	Tomimura <i>et al.</i> (2003)	AB093624
KD32J	<i>R. sativus</i>	Nankan, Kumamoto, Japan	1998	BR	Tomimura <i>et al.</i> (2003)	AB093621
KGD54J	<i>R. sativus</i>	Sendai, Kagoshima, Japan	1998	BR	Ohshima <i>et al.</i> (2007)	AB252123
KWB778J	<i>B. oleracea</i>	Takamatsu, Kagawa, Japan	2004	B	Ohshima <i>et al.</i> (2007)	AB252124
KWB779J	<i>B. rapa</i>	Takamatsu, Kagawa, Japan	2004	BR	Ohshima <i>et al.</i> (2007)	AB252125
KYD073J	<i>R. sativus</i>	Minoyama, Kyoto, Japan	2000	BR	Ohshima <i>et al.</i> (2007)	AB252126
KYD81J	<i>R. sativus</i>	Joyo, Kyoto, Japan	1998	BR	Tomimura <i>et al.</i> (2003)	AB093613
Lu2	<i>Brassica</i> sp.	-, Shandong, China	1986-1990	Not known		HQ446216
MED302J	<i>R. sativus</i>	Shiroyama, Mie, Japan	2001	BR	Ohshima <i>et al.</i> (2007)	AB252127
MYD013J	<i>R. sativus</i>	Yamamoto, Miyagi, Japan	2000	BR	Ohshima <i>et al.</i> (2007)	AB252128
MYD015J	<i>R. sativus</i>	Kesennuma, Miyagi, Japan	2000	BR	Ohshima <i>et al.</i> (2007)	AB252129
ND10J	<i>R. sativus</i>	Hirato, Nagasaki, Japan	1998	BR	Ohshima <i>et al.</i> (2007)	AB252130
NDJ	<i>R. sativus</i>	Takaki, Nagasaki, Japan	1997	BR	Tomimura <i>et al.</i> (2003)	AB093616
NID048J	<i>R. sativus</i>	Niitsu, Niigata, Japan	2000	BR	Ohshima <i>et al.</i> (2007)	AB252131
NID119J	<i>R. sativus</i>	Yuzawa, Niigata, Japan	1998	BR	Ohshima <i>et al.</i> (2007)	AB252132
NRD350J	<i>R. sativus</i>	Gojyo, Nara, Japan	2001	BR	Ohshima <i>et al.</i> (2007)	AB252134
RC4	<i>Zantedeschia</i> sp.	-, Taiwan	2000	BR	Chen <i>et al.</i> (2003)	AY134473
SGB088J	<i>B. rapa</i>	Hikone, Shiga, Japan	2000	BR	Ohshima <i>et al.</i> (2007)	AB252136
SGD311J	<i>R. sativus</i>	Nishiazai, Shiga, Japan	1998	BR	Tomimura <i>et al.</i> (2003)	AB093619
MDM060J	<i>R. sativus</i>	Gotsu, Shimane, Japan	2000	BR	Ohshima <i>et al.</i> (2007)	AB252137
FANX2	<i>R. sativus</i>	Tai'an, Shandong, China	2007	BR	Wang <i>et al.</i> (2009)	EU734433
FD88J	<i>R. sativus</i>	Tokyo, Tokyo, Japan	1998	BR	Tomimura <i>et al.</i> (2003)	AB093615
FRD052J	<i>R. sativus</i>	Akasaki, Tottori, Japan	2000	BR	Ohshima <i>et al.</i> (2007)	AB252138
FRD053J	<i>R. sativus</i>	Tomari, Tottori, Japan	2000	BR	Ohshima <i>et al.</i> (2007)	AB252139
Tu-2R1	<i>R. sativus</i>	-, Tochigi, Japan	Not known	BR	Suehiro <i>et al.</i> (2004)	AB105135
Tu-3	<i>B. oleracea</i>	-, Tochigi, Japan	Not known	B	Suehiro <i>et al.</i> (2004)	AB105134
FW	Not known	-, Taiwan	Not known	Not known		AF394602
V1ET15	<i>R. sativus</i>	Van Giang, Hung Yen, Vietnam	2006	B(R)	Nguyen <i>et al.</i> (2013a)	AB747286
V1ET56	<i>B. juncea</i>	Moc Chau, Son La, Vietnam	2007	B	Nguyen <i>et al.</i> (2013a)	AB747287
V1ET58	<i>B. juncea</i>	Moc Chau, Son La, Vietnam	2007	BR	Nguyen <i>et al.</i> (2013a)	AB747288
V1ET65	<i>R. sativus</i>	Gia Lam, Ha Noi, Vietnam	2007	BR	Nguyen <i>et al.</i> (2013a)	AB747289
V1ET66	<i>R. sativus</i>	Gia Lam, Ha Noi, Vietnam	2007	B	Nguyen <i>et al.</i> (2013a)	AB747290
V1ET73	<i>R. sativus</i>	Van Giang, Hung Yen, Vietnam	2007	BR	Nguyen <i>et al.</i> (2013a)	AB747291
V1ET79	<i>R. sativus</i>	Cam Giang, Hai Dung, Vietnam	2007	BR	Nguyen <i>et al.</i> (2013a)	AB747292
V1ET80	<i>R. sativus</i>	Cam Giang, Hai Dung, Vietnam	2007	B	Nguyen <i>et al.</i> (2013a)	AB747293
V1ET82	<i>R. sativus</i>	Ban Me Thuot, Dak Lak, Vietnam	2007	B(R)	Nguyen <i>et al.</i> (2013a)	AB747294
V1ET83	<i>R. sativus</i>	Ban Me Thuot, Dak Lak, Vietnam	2007	B	Nguyen <i>et al.</i> (2013a)	AB747295
V1ET89	<i>R. sativus</i>	Ban Me Thuot, Dak Lak, Vietnam	2007	BR	Nguyen <i>et al.</i> (2013a)	AB747296
V1ET138	<i>B. juncea</i>	Thanh Long, Thua Thien Hue, Vietnam	2007	B(R)	Nguyen <i>et al.</i> (2013a)	AB747297
V1ET153	<i>B. juncea</i>	Hoi An, Quang Nam, Vietnam	2007	B(R)	Nguyen <i>et al.</i> (2013a)	AB747298
V1ET158	<i>B. juncea</i>	Gia Lam, Ha Noi, Vietnam	2007	B(R)	Nguyen <i>et al.</i> (2013a)	AB747299
V1ET159	<i>B. juncea</i>	-, Lang Son, Vietnam	2007	B	Nguyen <i>et al.</i> (2013a)	AB747300
V1ET160	<i>B. juncea</i>	Huu Lung, Lang Son, Vietnam	2007	B	Nguyen <i>et al.</i> (2013a)	AB747301
V1ET164	<i>B. juncea</i>	Thuong Tin, Ha Tay, Vietnam	2007	B	Nguyen <i>et al.</i> (2013a)	AB747302
V1ET166	<i>B. juncea</i>	Thuong Tin, Ha Tay, Vietnam	2007	B	Nguyen <i>et al.</i> (2013a)	AB747303
V1ET167	<i>B. juncea</i>	Gia Lam, Ha Noi, Vietnam	2007	B	Nguyen <i>et al.</i> (2013a)	AB747304
V1ET169	<i>B. juncea</i>	Vo Cuong, Bac Ninh, Vietnam	2007	B	Nguyen <i>et al.</i> (2013a)	AB747305
V1ET170	<i>B. juncea</i>	Vo Cuong, Bac Ninh, Vietnam	2007	B(R)	Nguyen <i>et al.</i> (2013a)	AB747306
V1ET172	<i>B. juncea</i>	Gia Lam, Ha Noi, Vietnam	2007	B	Nguyen <i>et al.</i> (2013a)	AB747307
V1ET173	<i>B. juncea</i>	Viet Yen, Bac Giang, Vietnam	2007	B	Nguyen <i>et al.</i> (2013a)	AB747308
V1ET174	<i>B. juncea</i>	Viet Yen, Bac Giang, Vietnam	2007	B	Nguyen <i>et al.</i> (2013a)	AB747309
V1ET175	<i>B. juncea</i>	Viet Yen, Bac Giang, Vietnam	2007	B(R)	Nguyen <i>et al.</i> (2013a)	AB747310
V1ET176	<i>B. juncea</i>	Vu Thu, Thai Binh, Vietnam	2007	B(R)	Nguyen <i>et al.</i> (2013a)	AB747311
V1ET177	<i>B. juncea</i>	Vu Thu, Thai Binh, Vietnam	2008	B	Nguyen <i>et al.</i> (2013a)	AB747312
V1ET178	<i>B. juncea</i>	Nam Truc, Nam Dinh, Vietnam	2008	B(R)	Nguyen <i>et al.</i> (2013a)	AB747313
V1ET179	<i>B. juncea</i>	Nam Truc, Nam Dinh, Vietnam	2008	B(R)	Nguyen <i>et al.</i> (2013a)	AB747314
V1ET180	<i>B. juncea</i>	Viet Yen, Bac Giang, Vietnam	2008	B(R)	Nguyen <i>et al.</i> (2013a)	AB747315
YAD020J	<i>Raphanus sativus</i>	Shirataka, Yamagata, Japan	2000	BR	Ohshima <i>et al.</i> (2007)	AB252140
YAL018J	<i>Lactuca sativa</i>	Sakae, Yamagata, Japan	2000	BR	Ohshima <i>et al.</i> (2007)	AB252141
YCS	<i>Zantedeschia</i> sp.	-, Taiwan	2000	BR	Chen <i>et al.</i> (2003)	AF530055
YMD069J	<i>R. sativus</i>	Misumi, Yamaguchi, Japan	2000	BR	Ohshima <i>et al.</i> (2007)	AB252142
YMD070J	<i>R. sativus</i>	Abu, Yamaguchi, Japan	2000	BR	Ohshima <i>et al.</i> (2007)	AB252143
WFLB06	<i>R. sativus</i>	Weifang, Shandong, China	2006	BR	Wang <i>et al.</i> (2009)	EU734434
ZH1	<i>Phalaenopsis</i> sp.	-, China	2012	Not known		KF246570
Europe						
A102/11	<i>Anemone coronaria</i>	-, Liguria, Italy	1993	B	Tomimura <i>et al.</i> (2003)	AB093597
A64	<i>A. coronaria</i>	-, Liguria, Italy	1991	B	Tomimura <i>et al.</i> (2003)	AB093599
AI	<i>Alliaria officinalis</i>	-, Piedmont, Italy	1968	(B)	Tomimura <i>et al.</i> (2003)	AB093598
AI1A	<i>A. officinalis</i>	-, Denmark	1991	B	Nguyen <i>et al.</i> (2013b)	AB701694
ASP	<i>Allium</i> sp.	Gatersleben, Sachsen-Anhalt, Germany	1995	B	Nguyen <i>et al.</i> (2013b)	AB701697
BEL 1	<i>Rorippa nasturtium-aquaticum</i>	Wavre, Walloon Brabant, Belgium	1986	B	Nguyen <i>et al.</i> (2013b)	AB701698
Cal1	<i>Calendula officinalis</i>	-, Liguria, Italy	1979	BR	Tomimura <i>et al.</i> (2003)	AB093601
CAR37	<i>Cochlearia armoracia</i>	-, Poland	2004	Not known	Kozubek <i>et al.</i> (2007)	DQ648592
CAR37A	<i>C. armoracia</i>	-, Poland	2004	Not known	Kozubek <i>et al.</i> (2007)	DQ648591
CAR39	<i>C. armoracia</i>	-, Poland	2004	Not known		EF374098
CAR51	<i>C. armoracia</i>	-, Poland	2004	Not known		HQ637383
CRO184A	<i>Brassica napus</i>	Zagreb, Zagreb, Croatia	15. S. 2009	Not known	Musić <i>et al.</i> (2014)	KF595121
CZE 1	<i>B. oleracea</i>	Ruzyně-Prague, Prague, Czech Republic	1981	B	Tomimura <i>et al.</i> (2003)	AB093608
CZE 5	<i>B. rapa</i>	Ceske Budejovice, South Bohemian Region, Czech Republic	1993	B	Ohshima <i>et al.</i> (2007)	AB252107
DEU 1	Not known	-, Germany	<1976	B	Nguyen <i>et al.</i> (2013b)	AB701699
DEU 2	<i>Raphanus sativus</i>	-, Germany	<1993	B	Nguyen <i>et al.</i> (2013b)	AB701700

Formatted: Indent: Hanging: 0 cm, Left -2.02 ch

Formatted: Indent: Hanging: 3.55 ch, Left -2.02 ch,
First line: -3.55 ch

Formatted Table

Supplementary Table S1. Continued

isolate	Original host	Location (City, District, Country)	Year of collection	Host type	Reference	Accession code
Europe						
DEU 4	<i>Lactuca sativa</i>	Stuttgart, Baden-Württemberg, Germany	1986	BR	Nguyen <i>et al.</i> (2013b)	AB701701
DEU 5	<i>L. sativa</i>	Monchengladbach, Nordrhein-Westfalen, Germany	1991	B	Nguyen <i>et al.</i> (2013b)	AB701702
DEU 7	<i>L. sativa</i>	Frankfurt, Hessen, Germany	1994	B	Nguyen <i>et al.</i> (2013b)	AB701695
DNK 2	<i>B. napus</i>	-, -, Denmark	<1993	B	Ohshima <i>et al.</i> (2007)	AB252108
DNK 3	<i>B. rapa</i>	-, -, Denmark	1978	B	Ohshima <i>et al.</i> (2007)	AB701703
DNK 4	<i>B. rapa</i>	-, -, Denmark	1986	B	Nguyen <i>et al.</i> (2013b)	AB701704
Eru 1D	<i>Eruca sativa</i>	-, Piedmont, Italy	1991	B	Nguyen <i>et al.</i> (2013b)	AB701705
ESP 1	<i>Eruca vesicaria</i> subsp. <i>sativa</i>	-, -, Spain	2001	B	Nguyen <i>et al.</i> (2013b)	AB701706
ESP 2	<i>Sisymbrium orientale</i>	Las Matas, Aragón, Spain	2001	B	Nguyen <i>et al.</i> (2013b)	AB701707
FRA 2	<i>B. napus</i>	-, -, France	<1994	B	Nguyen <i>et al.</i> (2013b)	AB701708
FRD 1	<i>B. oleracea</i>	-, -, Germany	1987	B	Ohshima <i>et al.</i> (2007)	AB252112
GBR 7	<i>Rheum rhubarbarum</i>	-, Gloucestershire, UK	15.9.1993	B	Nguyen <i>et al.</i> (2013b)	AB701709
GBR 8	<i>Lunaria annua</i>	-, Essex, UK	20.4.1994	B	Nguyen <i>et al.</i> (2013b)	AB701710
GBR 27	<i>B. oleracea</i>	Kimmeridge, Dorset, UK	24.3.1999	B	Nguyen <i>et al.</i> (2013b)	AB701711
GBR 30	<i>B. oleracea</i>	Kimmeridge, Dorset, UK	26.4.1999	B	Nguyen <i>et al.</i> (2013b)	AB701712
GBR 31	<i>B. oleracea</i>	Chapman's Pool, Dorset, UK	26.4.1999	B	Nguyen <i>et al.</i> (2013b)	AB701713
GBR 32	<i>B. oleracea</i>	Chapman's Pool, Dorset, UK	26.4.1999	B	Nguyen <i>et al.</i> (2013b)	AB701714
GBR 36	<i>B. oleracea</i>	Winspit, Dorset, UK	18.6.1999	B	Ohshima <i>et al.</i> (2007)	AB252113
GBR 38	<i>B. oleracea</i>	Winspit, Dorset, UK	15.7.1999	B	Nguyen <i>et al.</i> (2013b)	AB701715
GBR 50	wild <i>B. oleracea</i>	Staithes, Yorkshire, UK	28.9.1999	B	Ohshima <i>et al.</i> (2007)	AB252114
GBR 51	wild <i>B. oleracea</i>	Staithes, Yorkshire, UK	28.9.1999	B	Nguyen <i>et al.</i> (2013b)	AB701742
GBR 57	wild <i>B. oleracea</i>	Llandudno, Conwy, UK	12.9.2000	B	Nguyen <i>et al.</i> (2013b)	AB701716
GBR 83	wild <i>B. oleracea</i>	Llandudno, Conwy, UK	20.8.2002	B	Nguyen <i>et al.</i> (2013b)	AB701717
GBR 91	wild <i>B. oleracea</i>	Llandudno, Conwy, UK	20.8.2002	B	Nguyen <i>et al.</i> (2013b)	AB701718
GBR 98	wild <i>B. oleracea</i>	Winspit, Dorset, UK	28.8.2002	B	Pallett <i>et al.</i> (2007)	EU861593
GIK1	<i>Matthiola incana</i>	-, -, Greece	<1989	B	Nguyen <i>et al.</i> (2013b)	AB701696
GRC 17	<i>B. oleracea</i>	Volos, Magnesia, Greece	1993	B	Ohshima <i>et al.</i> (2007)	AB252116
GRC 42	wild <i>Allium</i> sp.	-, -, Greece	1999	B	Ohshima <i>et al.</i> (2007)	AB252117
HUN 1	<i>Alliaria petiolata</i>	-, -, Hungary	<1996	B	Nguyen <i>et al.</i> (2013b)	AB701719
ITA 1A	<i>Brassica ruvo</i>	-, Campania, Italy	1990	B	Nguyen <i>et al.</i> (2013b)	AB701720
ITA 2	<i>Cheiranthus cheiri</i>	-, Campania, Italy	1992	BR	Nguyen <i>et al.</i> (2013b)	AB701721
ITA 3	<i>B. ruvo</i>	-, Campania, Italy	1990	B	Ohshima <i>et al.</i> (2007)	AB252122
ITA 4	<i>B. rapa</i>	-, Campania, Italy	1990	B	Nguyen <i>et al.</i> (2013b)	AB701722
ITA 5	<i>B. ruvo</i>	-, Campania, Italy	1990	B	Nguyen <i>et al.</i> (2013b)	AB701723
ITA 6	<i>M. incana</i>	-, Campania, Italy	1992	B	Nguyen <i>et al.</i> (2013b)	AB701724
ITA 7	<i>R. raphanistrum</i>	-, Campania, Italy	1990	BR	Tomimura <i>et al.</i> (2003)	AB093600
ITA 8	<i>Abutilon</i> sp.	-, Piedmont, Italy	09.1993	BR	Nguyen <i>et al.</i> (2013b)	AB701725
ITA 9A	<i>Cucurbita pepo</i>	-, -, Italy	<1995	B	Nguyen <i>et al.</i> (2013b)	AB701726
NLD 1	<i>B. oleracea</i>	-, -, The Netherlands	<1995	B	Ohshima <i>et al.</i> (2007)	AB252133
NLD 2	<i>B. oleracea</i>	-, -, The Netherlands	<1995	B	Nguyen <i>et al.</i> (2013b)	AB701727
DM-A	<i>Orchis militaris</i>	Celle, Lower Saxony, Germany	1981	DI ^c	Nguyen <i>et al.</i> (2013b)	AB701691
DM-N	<i>O. militaris</i>	Celle, Lower Saxony, Germany	1981	DI	Nguyen <i>et al.</i> (2013b)	AB701690
DRM	<i>O. morio</i>	Celle, Lower Saxony, Germany	1983	(B)	Nguyen <i>et al.</i> (2013b)	AB701692
DS	<i>O. simia</i>	Celle, Lower Saxony, Germany	1981	DI	Nguyen <i>et al.</i> (2013b)	AB701693
POL 1	<i>B. napus oleifera</i>	Poznań, Wielkopolska, Poland	<4.10.1993	B	Nguyen <i>et al.</i> (2013b)	AB701728
POL 2	<i>Papaver somniferum</i>	Czempin, -, Poland	<4.10.1993	B	Nguyen <i>et al.</i> (2013b)	AB701731
POL 4	<i>B. napus oleifera</i>	Grabianowo, Wielkopolska, Poland	<4.10.1993	B	Nguyen <i>et al.</i> (2013b)	AB701732
PRT 1	<i>B. oleracea acephala</i>	-, Madeira, Portugal	1993/1994	B	Nguyen <i>et al.</i> (2013b)	AB701729
PV0054	<i>B. oleacea</i>	-, -, Germany	Not known	B	Nguyen <i>et al.</i> (2013b)	AB701730
PV0104	<i>L. sativa</i>	Stuttgart, Baden-Württemberg, Germany	1986	BR	Tomimura <i>et al.</i> (2003)	AB093603
PV376-Br	<i>B. napus</i>	Braunschweig, Lower Saxony, Germany	1970	B	Tomimura <i>et al.</i> (2003)	AB093604
Rn98	<i>Ranunculus asiaticus</i>	-, Liguria, Italy	1997	B	Ohshima <i>et al.</i> (2007)	AB252135
RUS 1	<i>Armoracia rusticana</i>	-, -, Russia	1993	B	Tomimura <i>et al.</i> (2003)	AB093606
RUS 2	<i>B. napus</i>	Moscow, Moscow, Russia	Not known	B	Tomimura <i>et al.</i> (2003)	AB093607
It48	<i>Limonium sinuatum</i>	-, Toscana, Italy	1993	B	Tomimura <i>et al.</i> (2003)	AB093596
TGA	<i>Tigridia</i> sp.	Braunschweig, Lower Saxony, Germany	1983	(B)	Nguyen <i>et al.</i> (2013b)	AB701734
TGD	<i>Tigridia</i> sp.	Braunschweig, Lower Saxony, Germany	1983	(B)	Nguyen <i>et al.</i> (2013b)	AB701735
UK 1	<i>B. napus</i>	-, Warwickshire, UK	1975	B	Jenner <i>et al.</i> (2000)	AF169561
UT	<i>Utricularia</i> sp.	Wuerzburg, Bayern, Germany	1997	B	Nguyen <i>et al.</i> (2013b)	AB701736
Other						
BZ1	<i>B. oleracea</i>	-, Federal, Brazil	1996	B	Tomimura <i>et al.</i> (2003)	AB093611
CDN 1	<i>B. napus napobrassica</i>	-, -, Canada	<1988	B	Jenner <i>et al.</i> (2003)	AY227024
RNTRa6	<i>Rapistrum rugosum</i>	Varamin, Tehran, Iran	2004	B	Farzadfar <i>et al.</i> (2009)	AB440238
RNSS5	<i>Sisymbrium loeselii</i>	Semnan, Semnan, Iran	2003	B	Farzadfar <i>et al.</i> (2009)	AB440239
S1	<i>Allium ampeloprasum</i>	-, -, Israel	1993	B	Tomimura <i>et al.</i> (2003)	AB093602
KEN 1	<i>B. oleracea</i>	-, -, Kenya	1994	B	Tomimura <i>et al.</i> (2003)	AB093605
PV134	<i>Sesynibium</i> sp.	-, California, USA	<1960	B	Nguyen <i>et al.</i> (2013b)	AB701737
PV389	<i>Tulipa gesnerana</i>	Beltsville, Maryland, USA	1986	B	Nguyen <i>et al.</i> (2013b)	AB701738
Q-Ca	<i>B. rapa</i>	-, -, Canada	Not known	Not known	Nicolas & Laliberté (1991)	D10927
TUR1	<i>B. oleracea</i>	Canakkale, Marmora, Turkey	2004	B	Korkmaz <i>et al.</i> (2008)	AB362512
TUR9	<i>R. sativus</i>	Balikesir, Marmora, Turkey	2005	BR	Korkmaz <i>et al.</i> (2008)	AB362513
USA 1	<i>B. oleracea</i>	-, -, USA	<1980	B	Tomimura <i>et al.</i> (2003)	AB093609
USA 4	<i>B. pekinensis</i>	-, -, USA	1993	B	Nguyen <i>et al.</i> (2013b)	AB701739
USA 5	<i>R. sativus</i>	San Francisco, California, USA	2002	BR	Nguyen <i>et al.</i> (2013b)	AB701740
USA 6	<i>R. sativus</i>	San Francisco, California, USA	2002	BR	Nguyen <i>et al.</i> (2013b)	AB701741

Formatted Table

Supplementary Table S2. Recombination sites in the genomes of turnip mosaic virus of Australia and New Zealand

Isolate	Nucleotide position and protein-encoding region*	Parental isolate and subgroup†		Recombination detection program‡	P-values§	Z-value
		Major	Minor			
Australia						
AU1	2742 (P3) - 3475 (P3)	Lu2 (wB3)	AUST27 (bB2)	RGBMCS ₀ S ₀ P	2.04 × 10 ⁻⁴¹	6.86
AUST1	1080 (P1) - 3475 (P3)	GBR 27 (wB3)	AUST13 (bB2)	RGBMCS ₀ S ₀ P	1.96 × 10 ⁻¹¹⁵	5.92
AUST2	1341 (HC-Pro) - 2530 (HC-Pro)	AUST6 (bB2)	TIGD (bB2)	RGBMCS _R	1.29 × 10 ⁻¹⁴	<3.00
AUST3	1341 (HC-Pro) - 3475 (P3)	GBR 27 (wB3)	AUST13 (bB2)	RGBMCS ₀ S ₀ P	9.77 × 10 ⁻⁴⁴	4.94
	1341 (HC-Pro) - 2530 (HC-Pro)	AUST6 (bB2)	TIGD (bB2)	RGBMCS _R	4.08 × 10 ⁻¹⁴	<3.00
AUST4	1341 (HC-Pro) - 3475 (P3)	GBR 27 (wB3)	AUST13 (bB2)	RGBMCS ₀ S ₀ P	4.82 × 10 ⁻⁷⁹	4.95
	1341 (HC-Pro) - 2530 (HC-Pro)	AUST6 (bB2)	TIGD (bB2)	RGBMCS _R	1.68 × 10 ⁻¹⁴	<3.00
AUST6	1341 (HC-Pro) - 3475 (P3)	GBR 27 (wB3)	AUST13 (bB2)	RGBMCS ₀ S ₀ P	3.80 × 10 ⁻⁷⁵	5.61
	1080 (P1) - 3475 (P3)	GBR 27 (wB3)	AUST13 (bB2)	RGBMCS ₀ S ₀ P	9.97 × 10 ⁻¹¹⁶	4.78
AUST10	217 (P1) - 818 (P1)	BR51 (wB3)	GBR 91 (wB3)	RGBMCS ₀ S ₀ P	1.29 × 10 ⁻⁵¹	5.70
AUST13	6019 (VPg) - 8318 (Nib) (UD)	AlIA (bB2)	TIGA (bB2)	RGBMCS ₀ S ₀	1.47 × 10 ⁻¹⁹	3.83
	217 (P1) - 818 (P1)	GBR 27 (wB3)	AUST13 (bB2)	RGBMCS ₀ S ₀ P	5.97 × 10 ⁻⁴⁸	5.73
AUST19	6019 (VPg) - 8318 (Nib) (UD)	AlIA (bB2)	TIGA (bB2)	RGBMCS ₀ S ₀	1.47 × 10 ⁻¹⁹	3.72
	1 (5' NCR) - 1174 (P1)	CZE 1 (wB2)	PV134 (wB2)	RGBMCS ₀ S ₀	8.88 × 10 ⁻²⁷	4.66
AUST21	3094 (P3) (UD) - 5139 (CI)	NZ246 (wB2)	USA 4 (wB2)	RGBMCS ₀ S ₀	2.19 × 10 ⁻²⁹	4.44
	6132 (VPg) - 9834 (3' NCR)	USA 4 (wB2)	GBR 91 (wB3)	RGBMCS ₀ S ₀	8.82 × 10 ⁻²⁹	5.52
AUST22	237 (P1) - 1080 (P1)	NLD 2 (wB3)	DNK 3 (wB2)	RGBMCS ₀ S ₀ P	1.32 × 10 ⁻³⁰	3.18
	1080 (P1) - 1851 (HC-Pro)	AUST29 (bB2)	PV134 (bB2)	RGBMCS ₀ S ₀ P	3.06 × 10 ⁻¹²	4.31
AUST23	1080 (P1) - 3475 (P3)	GBR 27 (wB3)	AUST13 (bB2)	RGBMCS ₀ S ₀ P	2.03 × 10 ⁻⁹⁸	3.97
	1 (5' NCR) - 1174 (P1)	CZE 1 (wB2)	PV134 (wB2)	RGBMCS ₀ S ₀	1.14 × 10 ⁻⁵²	4.66
AUST24	3094 (P3) (UD) - 5139 (CI)	NZ246 (wB2)	USA 4 (wB2)	RGBMCS ₀ S ₀	3.05 × 10 ⁻²⁹	3.15
	6132 (VPg) - 9834 (3' NCR)	USA 4 (wB2)	GBR 91 (wB3)	RGBMCS ₀ S ₀	1.43 × 10 ⁻²²	5.52
AUST26	1341 (HC-Pro) - 2530 (HC-Pro)	AUST6 (bB2)	TIGD (bB2)	RGBMCS _R	9.29 × 10 ⁻¹⁵	<3.00
AUST27	1341 (HC-Pro) - 3475 (P3)	GBR 27 (wB3)	AUST13 (bB2)	RGBMCS ₀ S ₀ P	4.70 × 10 ⁻⁸³	5.19
	237 (P1) - 1080 (P1)	NLD 2 (wB3)	DNK 3 (wB2)	RGBMCS ₀ S ₀ P	2.45 × 10 ⁻³⁰	4.03
AUST28	1080 (P1) - 3475 (P3)	GBR 27 (wB3)	AUST13 (bB2)	RGBMCS ₀ S ₀ P	5.74 × 10 ⁻⁸⁹	4.06
	1341 (HC-Pro) - 2530 (HC-Pro)	AUST6 (bB2)	TIGD (bB2)	RGBMCS _R	8.42 × 10 ⁻¹⁵	<3.00
AUST29	1341 (HC-Pro) - 3475 (P3)	GBR 27 (wB3)	AUST13 (bB2)	RGBMCS ₀ S ₀ P	3.35 × 10 ⁻⁸¹	5.60
	1341 (HC-Pro) - 2530 (HC-Pro)	AUST6 (bB2)	TIGD (bB2)	RGBMCS _R	1.80 × 10 ⁻¹⁵	<3.00
BR51	1341 (HC-Pro) - 3475 (P3)	GBR 27 (wB3)	AUST13 (bB2)	RGBMCS ₀ S ₀ P	8.10 × 10 ⁻⁸⁴	5.19
BR51	6019 (VPg) - 7279 (Nib) (UD)	AlIA (bB2)	TIGA (bB2)	RGBMCS _R	1.75 × 10 ⁻¹⁹	<3.00
New Zealand						
NZ11	5602 (CI) - 9834 (3'NCR)	GBR 51 (wB3)	VIET153 (wB3)	RGBMCS ₀ S ₀	7.03 × 10 ⁻³⁷	3.73
NZ12	1 (5'NCR) - 1174 (P1)	CZE 1 (wB2)	PV134 (wB2)	RGBMCS ₀ S ₀	4.76 × 10 ⁻²²	7.95
NZ246	3063 (P3) - 5665 (CI)	NZ246 (wB2)	USA 4 (wB2)	RGBMCS _R	7.19 × 10 ⁻³²	<3.00
	1 (5'NCR) - 1174 (P1)	CZE 1 (wB2)	PV134 (wB2)	RGBMCS ₀ S ₀	1.24 × 10 ⁻²⁸	7.85
NZ290	1174 (P1) (UD) - 3063 (P3)	CDN1 (wB2)	DEU 2 (wB2)	RGBMCS ₀ S ₀	4.66 × 10 ⁻²⁴	4.49
	6132 (VPg) - 9834 (3'NCR)	USA 4 (wB2)	GBR 91 (wB3)	RGBMCS ₀ S ₀	2.13 × 10 ⁻¹⁶	3.32
NZ290	1 (5'NCR) - 1174 (P1)	CZE 1 (wB2)	PV134 (wB2)	RGBMCS ₀ S ₀	1.50 × 10 ⁻³⁵	7.31
	8071 (Nib) - 9834 (3'NCR)	POL 2 (wB2)	NZ246 (wB3)	RGBMCS ₀ S ₀	3.61 × 10 ⁻⁴¹	4.61
NZ402	1 (5'NCR) - 1174 (P1)	CZE 1 (wB2)	PV134 (wB2)	RGBMCS ₀ S ₀	4.50 × 10 ⁻²⁰	8.24
	1174 (P1) (UD) - 5219 (CI)	CDN1 (wB2)	DEU 2 (wB2)	RGBMCS ₀ S ₀	3.87 × 10 ⁻¹⁵	3.27
NZ403	6132 (VPg) - 9834 (3'NCR)	USA 4 (wB2)	GBR 91 (wB3)	RGBMCS ₀ S ₀	5.19 × 10 ⁻¹⁹	3.23
	402 (P1) - 2530 (HC-Pro)	BR51 (bB2)	DEU 7 (bB2)	RGBMCS ₀ S ₀ P	2.36 × 10 ⁻³¹	4.62
NZ403B	6019 (VPg) - 8993 (CP)	DEU 7 (bB2)	AUST10 (bB2)	RGBMCS ₀ S ₀ P	1.10 × 10 ⁻³¹	3.26
	402 (P1) - 2530 (HC-Pro)	BR51 (bB2)	DEU 7 (bB2)	RGBMCS ₀ S ₀ P	2.36 × 10 ⁻³¹	4.62
NZ412	6019 (VPg) - 8993 (CP)	DEU 7 (bB2)	AUST10 (bB2)	RGBMCS ₀ S ₀ P	1.10 × 10 ⁻³¹	3.26
	1 (5'NCR) - 1174 (P1)	CZE 1 (wB2)	PV134 (wB2)	RGBMCS ₀ S ₀	1.03 × 10 ⁻³⁵	7.31
NZ412B	8071 (Nib) - 9834 (3'NCR)	POL 2 (wB2)	NZ246 (wB3)	RGBMCS ₀ S ₀	1.54 × 10 ⁻⁴²	4.69
	1 (5'NCR) - 1174 (P1)	CZE 1 (wB2)	PV134 (wB2)	RGBMCS ₀ S ₀	1.03 × 10 ⁻³⁵	4.48
NZ415	8071 (Nib) - 9834 (3'NCR)	POL 2 (wB2)	NZ246 (wB3)	RGBMCS ₀ S ₀	1.40 × 10 ⁻⁴²	4.53
	402 (P1) - 2530 (HC-Pro)	BR51 (bB2)	DEU 7 (bB2)	RGBMCS ₀ S ₀ P	8.58 × 10 ⁻³²	4.48
NZ419	6019 (VPg) - 8993 (CP)	DEU 7 (bB2)	AUST10 (bB2)	RGBMCS ₀ S ₀ P	1.10 × 10 ⁻³¹	<3.00
	1 (5'NCR) - 1174 (P1)	CZE 1 (wB2)	PV134 (wB2)	RGBMCS ₀ S ₀	1.88 × 10 ⁻³¹	7.48
NZ419B	8071 (Nib) - 9834 (3'NCR)	POL 2 (wB2)	NZ246 (wB3)	RGBMCS ₀ S ₀	1.80 × 10 ⁻⁴²	4.25
	1 (5'NCR) - 1174 (P1)	CZE 1 (wB2)	PV134 (wB2)	RGBMCS ₀ S ₀	2.39 × 10 ⁻³¹	7.69
NZ419C	8071 (Nib) - 9834 (3'NCR)	POL 2 (wB2)	NZ246 (wB3)	RGBMCS ₀ S ₀	2.16 × 10 ⁻³¹	4.58
	1 (5'NCR) - 1174 (P1)	CZE 1 (wB2)	PV134 (wB2)	RGBMCS ₀ S ₀	2.16 × 10 ⁻³¹	7.69
NZL5	8071 (Nib) - 9834 (3'NCR)	POL 2 (wB2)	NZ246 (wB3)	RGBMCS ₀ S ₀	1.97 × 10 ⁻⁴²	4.17
	1 (5'NCR) - 1174 (P1)	CZE 1 (wB2)	PV134 (wB2)	RGBMCS ₀ S ₀	9.75 × 10 ⁻³⁵	7.31
NZW3	8071 (Nib) - 9834 (3'NCR)	POL 2 (wB2)	NZ246 (wB3)	RGBMCS ₀ S ₀	1.92 × 10 ⁻⁴¹	4.56
	1 (5'NCR) - 1174 (P1)	CZE 1 (wB2)	PV134 (wB2)	RGBMCS ₀ S ₀	4.03 × 10 ⁻³⁴	7.44
NZW4	8071 (Nib) - 9834 (3'NCR)	POL 2 (wB2)	NZ246 (wB3)	RGBMCS ₀ S ₀	2.96 × 10 ⁻⁴³	4.02
	1 (5'NCR) - 1174 (P1)	CZE 1 (wB2)	PV134 (wB2)	RGBMCS ₀ S ₀	7.15 × 10 ⁻²⁷	6.99
NZW6	1174 (P1) (UD) - 3063 (P3)	CDN1 (wB2)	NZ402 (wB2)	RGBMCS ₀ S ₀	1.14 × 10 ⁻²³	4.71
	6132 (VPg) - 9834 (3'NCR)	USA 4 (wB2)	GBR 91 (wB3)	RGBMCS ₀ S ₀	1.32 × 10 ⁻¹⁴	3.49
NZW6	1 (5'NCR) - 1174 (P1)	CZE 1 (wB2)	PV134 (wB2)	RGBMCS ₀ S ₀	1.03 × 10 ⁻³²	7.02
	8071 (Nib) - 9834 (3'NCR)	POL 2 (wB2)	NZ246 (wB3)	RGBMCS ₀ S ₀	8.47 × 10 ⁻³⁷	4.84

*Recombination sites detected in the turnip mosaic virus genomes by the recombination detection programs, from the aligned sequences of the likely recombinant and its 'parental isolates'. Nucleotide positions show locations of individual genes numbered as in the UK 1 genome (Jenner *et al.*, 2000). P1; Protein 1, HC-Pro; Helper-component proteinase protein, P3; Protein 3, CI; cylindrical inclusion protein, VPg; genome linked viral protein, Nib; Nuclear inclusion b protein and CP; coat protein, NCR; non-coding region, UD; Undetermined.

†bB2; basal-B2 subgroup, wB2; world-B2 subgroup, wB3; world-B3 subgroup.

‡Recombinant isolates identified by the recombination detection programs: R (RDP), G (GENECONV), B (BOOTSCAN), M (MAXCHI), C (CHIMAERA) and S_R (SISCAN) programs in RDP4 package (Martin *et al.*, 2010), and S₀ (SISCAN total nucleotide site analysis) in original SISCAN version 2 (Gibbs *et al.*, 2000) and P (PHYLPRO) (Weiller, 1998) programs. The analyses were done using default settings and a Bonferroni-corrected P-value cut-off of 0.01 in RDP4.

§The reported P-value is for the program in bold type and underlined in RDP4 package and is the smallest P-value among the isolates calculated for the region in question.

||Both of the parental isolates of the recombination sites had Z-values greater than 3 in total nucleotide site analysis in S₀ of the SISCAN version 2 program; thus lower Z-value of one of the parents identified are shown.

Supplementary Table S3. Haplotype and nucleotide diversities of Australia and New Zealand populations in turnip mosaic virus

Group and country	Protein encoding region*								
	Helper-component proteinase			Protein 3			Nuclear inclusion b		
	<i>n</i> [†]	<i>H</i> [‡]	<i>π</i> [§]	<i>n</i>	<i>H</i>	<i>π</i>	<i>n</i>	<i>H</i>	<i>π</i>
All groups									
Oceania	33	0.991±0.011	0.1439±0.0074	30	0.993±0.011	0.1490±0.0084	33	0.988±0.012	0.0905±0.0108
Australia	16	1.000±0.022	0.1365±0.0161	16	1.000±0.022	0.1004±0.0238	16	1.000±0.022	0.0749±0.0176
New Zealand	17	0.963±0.033	0.0933±0.0227	14	0.962±0.041	0.1115±0.0290	17	0.950±0.036	0.0863±0.0167
basal-B (B2)									
Oceania	15	0.990±0.028	0.0902±0.0084	16	0.992±0.025	0.0821±0.0156	5	0.900±0.016	0.0640±0.0129
Australia	12	1.000±0.034	0.0866±0.0100	13	1.000±0.030	0.0420±0.0053	2	1.000±0.500	0.0434±0.0219
New Zealand	3	0.667±0.314	0.0209±0.0098	3	0.667±0.314	0.0193±0.0091	3	0.667±0.314	0.0277±0.0131
world-B									
Oceania	18	0.974±0.029	0.0607±0.0137	14	0.974±0.039	0.0716±0.0243	28	0.986±0.015	0.0581±0.0025
Australia	4	1.000±0.177	0.1009±0.0273	3	1.000±0.272	0.1182±0.0547	14	1.000±0.027	0.0429±0.0042
New Zealand	14	0.956±0.045	0.0410±0.0145	11	0.956±0.059	0.0388±0.0273	14	0.936±0.051	0.0455±0.0090
world-B2									
Oceania	15	0.962±0.040	0.0287±0.0047	12	0.964±0.051	0.0271±0.0111	9	0.821±0.101	0.0014±0.0003
Australia	2	1.000±0.500	0.0032±0.0016	2	1.000±0.500	0.0033±0.0017	0	ND	ND
New Zealand	13	0.949±0.051	0.0248±0.0060	10	0.944±0.070	0.0033±0.0004	9	0.821±0.101	0.0014±0.0003
world-B3									
Oceania	3	1.000±0.272	0.0478±0.0135	2	1.000±0.500	0.0970±0.0485	19	1.000±0.017	0.0483±0.0034
Australia	2	1.000±0.500	0.0388±0.0194	1	ND	ND	14	1.000±0.027	0.0429±0.0042
New Zealand	1	ND	ND	1	ND	ND	5	1.000±0.126	0.0406±0.0084

Partial helper-component (HC-Pro), Protein 3 (P3*) and nuclear inclusion b (Nib*) regions (see Methods).

[†]Number of sequences.

[‡]Haplotype diversity.

[§]Nucleotide diversity was estimated by the average pairwise difference between sequences in a sample, based on all sites.

^{||}Not determined.

Supplementary References

- Chen, C. C., Chao, C. H., Chen, C. C., Yeh, S. D., Tsai, H. T. & Chang, C. A. (2003).** Identification of *Turnip mosaic virus* isolates causing yellow stripe and spot on calla lily. *Plant Dis* **87**, 901–905.
- Chen, J., Zheng, H. Y., Chen, J. P. & Adams, M. J. (2002).** Characterisation of a potyvirus and a potexvirus from Chinese scallion. *Arch Virol* **147**, 683–693.
- Chen, J., Lu, Y.-W., Shi, Y.-H., Adams, M. J. & Chen, J. -P. (2006).** Complete nucleotide sequence of the genomic RNA of Narcissus yellow stripe virus from Chinese narcissus in Zhangzhou city, China. *Arch Virol* **151**, 1673–1677.
- Farzadfar, S., Tomitaka, Y., Ikematsu, M., Golnaraghi, A., Pourrahim, R. & Ohshima, K. (2009).** Molecular characterisation of *Turnip mosaic virus* isolates from Brassicaceae weeds. *Eur J Plant Pathol* **124**, 45–55.
- Fletcher, J. D., Lister, R. A., Bulman, S. R. & Heenan, P. B. (2010).** First record of *Turnip mosaic virus* in *Pachycladon* spp. (Brassicaceae): an endangered native plant species in New Zealand. *Australas Plant Dis Notes* **5**, 9–10.
- Fuji, S. & Nakamae, H. (1999).** Complete nucleotide sequence of the genomic RNA of a Japanese yam mosaic virus, a new potyvirus in Japan. *Arch Virol* **144**, 231–240.
- Fuji, S. & Nakamae, H. (2000).** Complete nucleotide sequence of the genomic RNA of a mild strain of Japanese yam mosaic potyvirus. *Arch Virol* **145**, 635–640.
- Gibbs, M. J., Armstrong, J. S. & Gibbs, A. J. (2000).** Sister-scanning: a Monte Carlo procedure for assessing signals in recombinant sequences. *Bioinformatics* **16**, 573–582.
- Huson, D. H. & Bryant, D. (2006).** Application of phylogenetic networks in evolutionary studies. *Mol Biol Evol* **23**, 254–267.
- Jenner, C. E., Sanchez, F., Nettleship, S. B., Foster, G. D., Ponz, F. & Walsh, J. A. (2000).** The cylindrical inclusion gene of *Turnip mosaic virus* encodes a pathogenic determinant to the brassica resistance gene *TuRB01*. *Mol Plant Microbe Interact* **13**, 1102–1108.
- Jenner, C. E., Tomimura, K., Ohshima, K., Hughes, S. L. & Walsh, J. A. (2002).** Mutations in *Turnip mosaic virus* P3 and cylindrical inclusion proteins are separately required to overcome two *Brassica napus* resistance genes. *Virology* **300**, 50–59.
- Jenner, C. E., Wang, X., Tomimura, K., Ohshima, K., Ponz, F. & Walsh, J. A. (2003).** The dual role of the potyvirus P3 protein of *Turnip mosaic virus* as a symptom and avirulence determinant in brassicas. *Mol Plant Microbe Interact* **16**, 777–784.
- Korkmaz, S., Tomitaka, Y., Onder, S. & Ohshima, K. (2008).** Occurrence and molecular characterization of Turkish isolates of *Turnip mosaic virus*. *Plant Pathol* **57**, 1155–1162.
- Kozubek, E., Irzykowski, W. & Lehmann, P. (2007).** Genetic and molecular variability of a *Turnip mosaic virus* population from horseradish (*Cochlearia armoracia* L.). *J Appl Genet* **48**, 295–306.
- Lin, S.-Q., Shen, J.-G., Gao, F.-L., Cai, W., Huang, Z., Xie, L.-Y. & Wu, Z.-J. (2012).** Complete genome sequence of narcissus latent season yellows virus infecting Chinese narcissus in China. *Arch Virol* **157**, 1821–1824.
- Martin, D. P., Lemey, P., Lott, M., Moulton, V., Posada, D. & Lefevre, P. (2010).** RDP3: a flexible and fast computer program for analyzing recombination. *Bioinformatics* **26**, 2462–2463.
- Musić, M. Š., Nguyen, H. D., Černi, S., Mamula, Đ., Ohshima, K. & Škorić, D. (2014).** Multilocus sequence analysis of ‘*Candidatus* Phytoplasma asteris’ strain and the genome analysis of *Turnip mosaic virus* co-infecting oilseed rape. *J Appl Microbiol* **117**, 774–785.
- Nguyen, H. D., Tran, H. T. N. & Ohshima, K. (2013a).** Genetic variation of the *Turnip mosaic virus* population of Vietnam: A case study of founder, regional and local influences. *Virus Res* **171**,

138–149.

Nguyen, H. D., Tomitaka, Y., Ho, S. Y. W., Duchêne, S., Vetten, H.-J., Lesemann, D., Walsh, J. A., Gibbs, A. J. & Ohshima, K. (2013b). Turnip mosaic potyvirus probably first spread to Eurasian brassica crops from wild orchids about 1000 years ago. *PLoS ONE* **8**, e55336.

Nicolas, O. & Laliberté, J. F. (1991). The use of PCR for cloning of large cDNA fragments of turnip mosaic potyvirus. *J Virol Methods* **32**, 57–66.

Ochoa Corona, F. M., Lebas, B. S. M., Elliott, D. R., Tang, J. Z. & Alexander, B. J. R. (2007). New host records and new host family range for *Turnip mosaic virus* in New Zealand. *Australas Plant Dis Notes* **2**, 127–130.

Ohshima, K., Tanaka, M. & Sako, N. (1996). The complete nucleotide sequence of turnip mosaic virus RNA Japanese strain. *Arch Virol* **141**, 1991–1997.

Ohshima, K., Tomitaka, Y., Wood, J. T., Minematsu, Y., Kajiyama, H., Tomimura, K. & Gibbs, A. J. (2007). Patterns of recombination in turnip mosaic virus genomic sequences indicate hotspots of recombination. *J Gen Virol* **88**, 298–315.

Pallett, D. W., Cooper, J. I., Wang, H., Reeves, J., Luo, Z., Machado, R., Obermeier, C., Walsh, J. A. & Kearsey, M. J. (2007). Variation in the pathogenicity of two *Turnip mosaic virus* isolates in wild *Brassica rapa* provenances. *Plant Pathol* **57**, 401–407.

Schwinghamer, M. W., Schilg, M. A., Walsh, J. A., Bambach, R. W., Cossu, R. M., Bambridge, J. M., Hind-Lanoiselet, T. L., McCorkell, B. E. & Cross, P. (2014). *Turnip mosaic virus*: potential for crop losses in the grain belt of New South Wales, Australia. *Australas Plant Pathol* Published online 2014 July 2 DOI: 10.1007/s13313-014-0304-9.

Suehiro, N., Natsuaki, T., Watanabe, T. & Okuda, S. (2004). An important determinant of the ability of *Turnip mosaic virus* to infect *Brassica* spp. and/or *Raphanus sativus* is in its P3 protein. *J Gen Virol* **85**, 2087–2098.

Tomimura, K., Gibbs, A. J., Jenner, C. E., Walsh, J. A. & Ohshima, K. (2003). The phylogeny of *Turnip mosaic virus*; comparisons of 38 genomic sequences reveal a Eurasian origin and a recent 'emergence' in east Asia. *Mol Ecol* **12**, 2099–2111.

Wang, H. Y., Liu, J. L., Gao, R., Chen, J., Shao, Y. H. & Li, X. D. (2009). Complete genomic sequence analyses of *Turnip mosaic virus* basal-BR isolates from China. *Virus Genes* **38**, 421–428.

Weiller, G. F. (1998). Phylogenetic profiles: a graphical method for detecting genetic recombinations in homologous sequences. *Mol Biol Evol* **15**, 326–355.

Wylie, S. J., Li, H., Sivasithamparam, K. & Jones, M. G. K. (2014). Complete genome analysis of three isolates of narcissus late season yellows virus and two of narcissus yellow stripe virus: three species or one? *Arch Virol* **159**, 1521–1525.