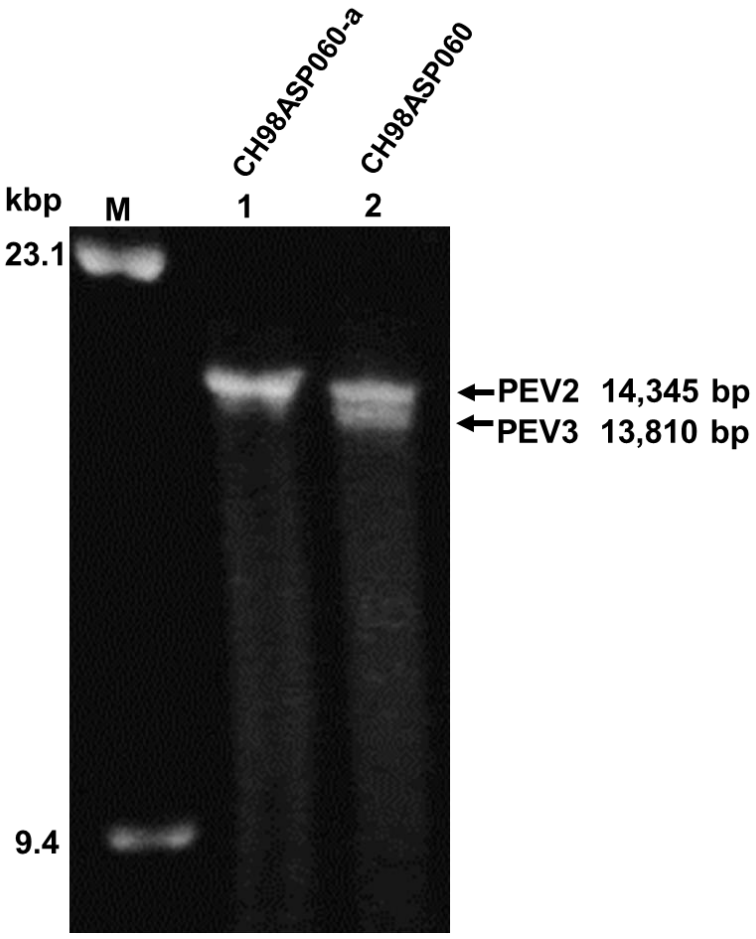
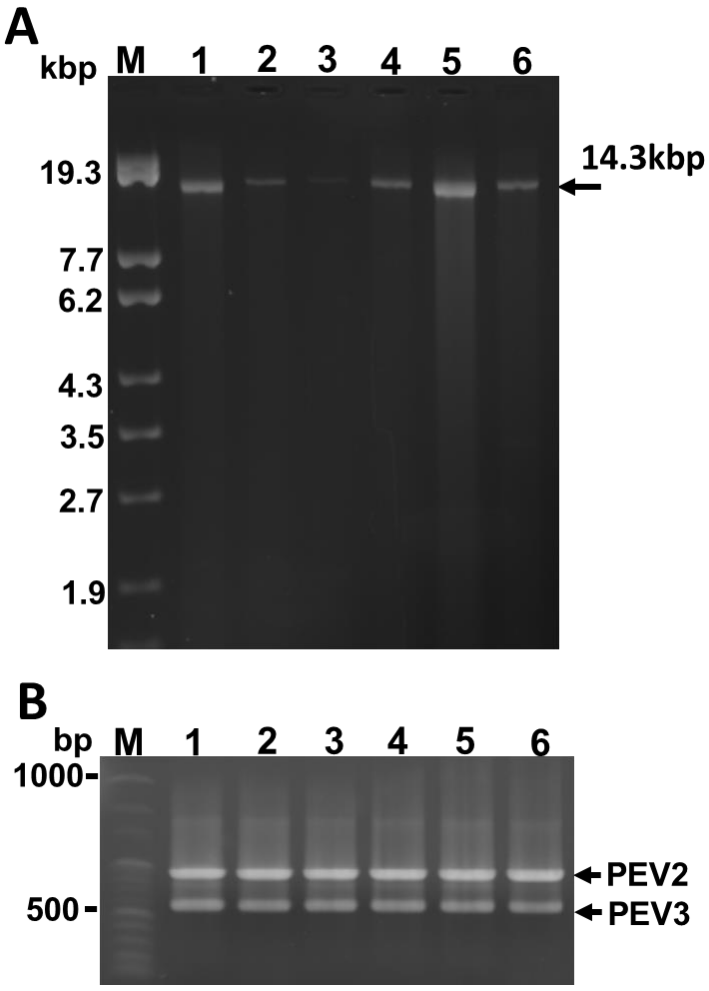
Supplementary Material



Supplementary Figure 1. Agarose gel electrophoresis of the PEV2 and PEV3 dsRNAs. The electrophoresis conditions were: 0.6 % agarose, 20V, 50h, stained with 0.5 mg/ml ethidium bromide. Lane M, DNA size markers (250 ng of λ DNA digested with Hind III) ; lane 1, CH98ASP060-a/PEV2&PEV3#; lane 2, CH98ASP060/PEV2&PEV3.



Supplementary Figure 2. Detection of the dsRNA genomes of PEV2 and PEV3 in *Phytophthora* sp. isolates grown on PDA or in PD broth containing 100 µg ml-1 metalaxyl. (A) Agarose gel electrophoresis of dsRNAs purified from the three PEV2 and PEV3 high-titer isolates. The intensities of the bands were semi-quantified by densitometry using a CS-Analyzerver.3.0 (ATTO). Lane 1, 51.2 ng; lane 2, 15.7 ng; lane 3, 5.3 ng; lane 4, 30.0 ng; lane 5, 48.6 ng; lane 6, 35.8 ng. (B) RT-PCR amplification using PEV2 and PEV3-specific primers (Table S2). Lane designations: 1–3, After subculturing 5 times on PDA medium without metalaxyl, the isolates were grown in PD broth under static culture conditions. 4–6, After subculturing 5 times on PDA medium containing 100 mg ml^{-1} metalaxyl, the isolates were grown in PD broth under static culture conditions. M, DNA size markers (300 ng of λ DNA digested with EcoT14I); lanes 1 and 4, CH98ASP060-a/PEV2&PEV3#; lanes 2 and 5, CH98ASP060/PEV2&PEV3; lanes 3 and 6, CH98ASP059/PEV2&PEV3.

Supplementary Table S1. Occurrence of dsRNAs in 68 *Phytophthora* isolates and 2 Pythium isolates.

Species, host	Isolate	Location	dsRNA	Species, host	Isolate	Location	dsRNA
Phytophthora sp.				*P. cactorum*			
Asparagus	CH98ASP060	Toyama	+	Loquat	CH98LOQ1 MAFF242859	Chiba	−
Asparagus	CH98ASP051	Toyama	+	*P. citrophthora*			
Asparagus	CH98ASP059	Toyama	+	Kiwifruit	CH90-15 MAFF245812	Chiba	−
Asparagus	CH98ASP066	Toyama	+	Kiwifruit	CH90-16	Chiba	−
Asparagus	Ku-1	Hokkaido	+	Kiwifruit	CH90-19 MAFF242874	Chiba	−
Asparagus	Ak-6-1	Akita	+	Citrus unshiu	CH98U7B	Chiba	−
Asparagus	Fk-3	Fukushima	+	Citrus unshiu	CH98U8B	Chiba	−
P. nicotianae				*P. cryptogea*			
Carrot	CH08DC9	Okinawa	−	Carnation	CH96CAR51	Chiba	−
Roselle	CH08HS1	Okinawa	−	Carnation	CH96CAR4	Chiba	−
Roselle	CH08HS3	Okinawa	−	Carnation	CH96CAR8	Chiba	−
Roselle	CH08HS7	Okinawa	−	Gerbera	CH95PHG4	Chiba	−
Roselle	CH08HS9	Okinawa	−	Gerbera	CH97PHG9	Chiba	−
Roselle	CH08HS10	Okinawa	−	Eustoma	CH95PHE26	Chiba	−
Kidny bean	CH1999PV14	Chiba	−	Eustoma	CH95PHE27	Ibaraki	−
Lavender	CH99LAV1-1	Chiba	−	Eustoma	CH95PHE10 MAFF245820	Chiba	−
Lavender	CH99LAV1-2	Chiba	−	Eustoma	CH95PHE16 MAFF242880	Ibaraki	−
Strelitzia	CH07STR23	Chiba	−	*P. palmivora*			
Strelitzia	CH07STR25	Chiba	−	Oncidium	CH88-1 MAFF242892	Chiba	−
Strelitzia	CH07STR32	Chiba	−	Cymbidium	CH05PAL051	Chiba	−
Strelitzia	CH07STR34	Chiba	−	Cymbidium	CH06PAL061	Chiba	−
Strelitzia	CH07STR34-2	Chiba	−	Citrus	CH99KP1	Chiba	−
Strelitzia	CH07STR34-3	Chiba	−	Strelitzia	CH07STR12	Chiba	−
Strelitzia	CH07STR42	Chiba	−	Strelitzia	CH07STR14	Chiba	−
Strelitzia	CH07STR43	Chiba	−	*P. citricola*			
Strelitzia	CH07STR42 (4-4)	Chiba	−	Citrus unshiu	CH98U121C	Chiba	−
Strelitzia	CH07STR42 (4-5)	Chiba	−	Citrus unshiu	CH98U122C	Chiba	−
Strelitzia	CH07STR72	Chiba	−	Citrus unshiu	CH98U132C	Chiba	−
Strelitzia	CH07STR81	Chiba	−	*P. cinnamomi*			
Strelitzia	CH07STR101	Chiba	−	Eustoma	CH95PHE1	Ibaraki	−
Citrus junos	CH98Y1A-W-2 MAFF245844	Chiba	−	Eustoma	CH95PHE1-1	Ibaraki	−
Citrus junos	CH98Y1A-W-3 MAFF245844	Chiba	−	Eustoma	CH95PHE4	Ibaraki	−
Citrus junos	CH98Y2A	Chiba	−	Eustoma	CH95PHE20	Ibaraki	−

Citrus junos	CH98Y2A-1	Chiba	−	*Pythium spp.*			
Bougainvillea	CH89-50	Chiba	−	Nemophila	CH98PYNE1	Chiba	−
Dianthus	CH87KY22	Chiba	−	Ranunculus	CH08RAPY9	Chiba	−
Dianthus	CH99KY11	Chiba	−				
Easter lily	CH91PKL3	Chiba	−				
Parsley	CH85PHP105	Chiba	−				
Parsley	CH85PHP61	Chiba	−				
Carnation	CH01DH1	Chiba	−				

+, infection; -, negative.

Supplementary Table S2. List of primers used in the study.

primer name	sequence (5 '-3 ')	position
PEV2-1F	AACCACACTTGCGAGCCTATGAAC	PEV2 (2369-2392)
PEV2-1R	GTCGCCCAGACTAGTTTCAATTGC	PEV2 (3305-3328)
PEV2-5' RACE	GGTCAAGACAGGCGGTAATCTCG	PEV2 (144-166)
PEV2-3' RACE	GTGATGTTCACCAAGCATGGGACGTTCTG	PEV2 (13904-13932)
PEV3-1F	GTTCCAATACCGTCCAACGTGTC	PEV3 (961-983)
PEV3-1R	ACTTCACCAGGGACCTTCATGG	PEV3 (1559-1580)
PEV3-5' RACE	CTTGTACCTATTTGTAAGTCTTTAGGTGATGG	PEV3 (214-245)
PEV3-3' RACE	CACGGCACTTTCTGTAGTATGGTGGCTTAC	PEV3 (13396-13425)
oligo-dT	CGA TGG TAC CTG CAG GCG CGC CTT TTT TTT TTT TTT TTT	for 3' RACE
oligo-dT AP	CGA TGG TAC CTG CAG GCG CGC C	for 3' RACE

Supplementary Table S3. Amino acid identities between the RdRp regions of PEV2 and PEV3 and those of other endornaviruses.

virus name	**RdRp**		**Sequence ID**
	PEV2	**PEV3**	
Lagenaria siceraria endornavirus	-	43%	YP_009010973.1
Cucumis melo endornavirus	43%	45%	YP_009222598.1
Yerba mate endornavirus	45%	46%	YP_009046830.1
Vicia faba endornavirus	49%	44%	YP_438201.1
Phytophthora endornavirus 1	53%	72%	YP_241110.1
Hordeum vulgare endornavirus	43%	44%	YP_009212849.1
Winged bean endornavirus 1	41%	44%	YP_009305414.1
Phaseolus vulgaris endornavirus 2	42%	44%	BAM68540.1
Hot pepper endornavirus	43%	43%	YP_009165596.1
Rhizoctonia cerealis endornavirus 1	48%	46%	YP_008719905.1
Rhizoctonia solani endornavirus 1	43%	-	YP_009552276.1

Arthrocladiella mougeotii endornavirus	-	44%	AZO92732.1
Helianthus annuus endornavirus	47%	43%	YP_009553502.1
Brown algae endornavirus 1	47%	49%	BBZ90073.1
Brown algae endornavirus 2	49%	-	BBZ90074.1
Bremia lactucae associated endornavirus 1	52%	75%	QIP68005.1

Supplementary Table S4. Amino acid identities between the viral helicase (Hel-1) motifs of PEV2 and PEV3 and those of other endornaviruses.

virus name	Hel-1		Sequence ID
	PEV2	PEV3	
Lagenaria siceraria endornavirus	31%	30%	YP_009010973.1
Cucumis melo endornavirus	33%	-	YP_009222598.1
Yerba mate endornavirus	31%	-	YP_009046830.1
Persea americana endornavirus 1	33%	-	YP_005086952.1
Oryza sativa endornavirus	32%	30%	YP_438200.1
Oryza rufipogon endornavirus	-	31%	YP_438202.1
Vicia faba endornavirus	33%	33%	YP_438201.1
Phytophthora endornavirus 1	39%	58%	YP_241110.1
Hordeum vulgare endornavirus	27%	-	YP_009212849.1
Winged bean endornavirus 1	28%	28%	YP_009305414.1
Phaseolus vulgaris endornavirus 2	-	34%	BAM68540.1
Hot pepper endornavirus	-	34%	YP_009165596.1
Rhizoctonia cerealis endornavirus 1	30%	30%	YP_008719905.1
Agaricus bisporus endornavirus 1	-	32%	AQM32768.1
Grapevine endophyte endornavirus	25%	29%	YP_007003829.1
Erysiphe cichoracearum endornavirus	27%	28%	YP_009225663.1
Rhizoctonia solani endornavirus 1	25%	29%	YP_009552276.1
Arthrocladiella mougeotii endornavirus	-	30%	AZO92732.1
Helianthus annuus endornavirus	-	31%	YP_009553502.1
Brown algae endornavirus 1	29%	31%	BBZ90073.1
Brown algae endornavirus 2	32%	33%	BBZ90074.1
Geranium carolinianum endornavirus 1	-	27%	QBB21108.1
Bremia lactucae associated endornavirus 1	39%	63%	QIP68005.1

Supplementary Table S5. GenBank accession numbers of the virus-encoded amino acid sequences used in the phylogenetic analysis**.**

Virus name	Accession	Genus	Family
Lagenaria siceraria endornavirus	YP_009010973.1	*Alphaendornavirus*	*Endornaviridae*
Cucumis melo endornavirus	YP_009222598.1	*Alphaendornavirus*	*Endornaviridae*

Phaseolus vulgaris endornavirus 1	YP_009011062.1	*Alphaendornavirus*	*Endornaviridae*
Basella alba endornavirus 1	AB844264.1	*Alphaendornavirus*	*Endornaviridae*
Yerba mate endornavirus	YP_009046830.1	*Alphaendornavirus*	*Endornaviridae*
Persea americana endornavirus 1	YP_005086952.1	*Alphaendornavirus*	*Endornaviridae*
Oryza sativa endornavirus	YP_438200.1	*Alphaendornavirus*	*Endornaviridae*
Oryza rufipogon endornavirus	YP_438202.1	*Alphaendornavirus*	*Endornaviridae*
Vicia faba endornavirus	YP_438201.1	*Alphaendornavirus*	*Endornaviridae*
Phytophthora endornavirus 1	YP_241110.1	*Alphaendornavirus*	*Endornaviridae*
Hordeum vulgare endornavirus	YP_009212849.1	*Alphaendornavirus*	*Endornaviridae*
Winged bean endornavirus 1	YP_009305414.1	*Alphaendornavirus*	*Endornaviridae*
Phaseolus vulgaris endornavirus 2	BAM68540.1	*Alphaendornavirus*	*Endornaviridae*
Bell pepper endornavirus	YP_004765011.1	*Alphaendornavirus*	*Endornaviridae*
Hot pepper endornavirus	YP_009165596.1	*Alphaendornavirus*	*Endornaviridae*
Helicobasidium mompa endornavirus 1	YP_003280846.1	*Alphaendornavirus*	*Endornaviridae*
Rhizoctonia cerealis endornavirus 1	YP_008719905.1	*Alphaendornavirus*	*Endornaviridae*
Agaricus bisporus endornavirus 1	AQM32768.1	*Alphaendornavirus*	*Endornaviridae*
Grapevine endophyte endornavirus	YP_007003829.1	*Alphaendornavirus*	*Endornaviridae*
Erysiphe cichoracearum endornavirus	YP_009225663.1	NA	NA
Cluster bean endornavirus 1	AYA60157.1	NA	NA
Phaseolus vulgaris endornavirus 3	AXB99512.1	NA	NA
Rhizoctonia solani endornavirus 1	YP_009552276.1	NA	NA
Arthrocladiella mougeotii endornavirus	AZO92732.1	NA	NA
Helianthus annuus endornavirus	YP_009553502.1	NA	NA
Brown algae endornavirus 1	BBZ90073.1	NA	NA
Brown algae endornavirus 2	BBZ90074.1	NA	NA
Geranium carolinianum endornavirus 1	QBB21108.1	NA	NA
Phytophthora endornavirus 2	LC586217	NA	NA
Phytophthora endornavirus 3	LC586218	NA	NA
Bremia lactucae associated endornavirus 1	QIP68005.1	NA	NA
Alternaria brassicicola endornavirus 1	YP_009115493.1	*Betaendornavirus*	*Endornaviridae*
Tuber aestivum endornavirus	YP_004123950.1	*Betaendornavirus*	*Endornaviridae*
Gremmeniella abietina endornavirus 1	YP_529670.1	*Betaendornavirus*	*Endornaviridae*
Sclerotinia sclerotiorum endornavirus 1	YP_009022070.1	*Betaendornavirus*	*Endornaviridae*
Botrytis cinerea endornavirus 1	YP_009315910.1	*Betaendornavirus*	*Endornaviridae*
Rosellinia necatrix endornavirus 1	YP_009276355.1	NA	NA
Sclerotinia minor endornavirus 1	YP_009552723.1	NA	NA
Grapevine leafroll-associated virus 1	YP_004940642	*Ampelovirus*	*Closteroviridae*

NA= Not available.

Supplementary Table S6. Sensitivities of the *Phytophthora* sp. isolates to four fungicides, based on the minimal inhibitory concentrations (MICs).

Isolate	endornaviruses	MIC (μg ml $^{-1}$)			
		benthiavalicarb-isopropyl	famoxadone + 1mM PG	metalaxyl	chlorothalonil
CH98APS060	PEV2&PEV3	0.03	1.5	>100[a]	>400
CH98APS060-a	PEV2&PEV3#	0.03	1.5	>100	>400
CH98ASP059	PEV2&PEV3	0.03	1.5	>100	>400
CH98ASP059-L	PEV2#&PEV3#	0.3	>150	10.0	>400

[a]The MIC value is shown with the recommended concentration as the upper limit.

Supplementary Table S7. Sensitivities of the *Phytophthora* sp. isolates to famoxadone on PDA medium without the addition of n-propyl gallate.

Isolate	endornaviruses	Mycelial growth inhibition (%) at famoxadone (μg ml $^{-1}$)						
		0.0015	0.015	0.15	1.5	15	150[a]	300[b]
CH98APS060	PEV2&PEV3	0.0	7.0	0.0	22.0**	17.0	84.0	79.6
CH98APS060-a	PEV2&PEV3#	0.0	23.8	73.5	79.6**	78.2	89.0	89.9
CH98ASP059	PEV2&PEV3	0.0	0.0	0.0	15.0**	15.0	72.6	66.6
CH98ASP059-L	PEV2#&PEV3#	0.0	0.0	0.0	0.0**	0.0	0.0	0.0

[a]The recommended concentration for commercial use.
[b]Five times the recommended concentration for commercial use.
** indicate p value < 0.01, respectively (the Tukey-Kramer range test).

Supplementary Table S8. Sensitivities of *Phytophthora* sp. isolates to famoxadone (FA) and/or n-propyl gallate (PG) on potato dextrose agar medium.

Isolate	endornaviruses	Mycelial growth inhibition (%) at		
		FA 1.5μg ml $^{-1}$	FA 1.5μg ml $^{-1}$ + 1mM PG	1mM PG
CH98APS060	PEV2&PEV3	22.0	100.0	59.5
CH98APS060-a	PEV2&PEV3#	79.6	100.0	77.1
CH98ASP059	PEV2&PEV3	15.0	100.0	57.6
CH98ASP059-L	PEV2#&PEV3#	0.0	14.1	25.0