

Supplementary Information

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Title: Recombination at the emergence of the pathogenic rabbit haemorrhagic disease virus *Lagovirus europaeus*/GI.2

Table. List of the 221 sequences used in the study and the genotype/variant they belong to according to their VP60.

GenBank accession number	Strain name	Genotype/Variant (VP60)
AB300693	Hokkaido/2002/JPN_2002	GI.1a
AF258618	Iowa2000_USA	GI.1a
AF295785	Mexico89_1989	GI.1c
AY523410	CD/China	GI.1a
DQ189077	Bahrain_2001	GI.1d
DQ189078	Saudi_Arabia	GI.1c
DQ205345	JX/CHA/97_China_1997	GI.1a
DQ280493	ChinaWHNRH	GI.1a
EF363035	clonepJG-RHDV-DD06_Ramsay Island_1999	GI.1d
EF558572	Frankfurt12_Germany_1996	GI.1d
EF558573	Frankfurt5_Germany	GI.1d
EF558574	Wika_Germany_1996	GI.1d
EF558575	Ascot_UK_1992	GI.1d
EF558576	Jena_Germany	GI.1d
EF558577	Meiningen_Germany_1993	GI.1d
EF558578	Eisenhutenstadt_Germany_1989	GI.1b
EF558579	NZ54_New Zealand_2003	GI.1c
EF558580	NZ61_New Zealand_2003	GI.1c
EF558581	Erfurt_Germany_2000	GI.1a
EF558582	Dachswald_Germany_2000	GI.1a
EF558583	Triptis_Germany_1996	GI.1a
EF558584	Rossi_Germany_2002	GI.1a
EF558585	Hagenow_Germany_1990	GI.1a
EF558586	Hartmannsdorf_Germany_1989	GI.1a
EU003578	IN-05_USA_2005	GI.1a
EU003579	Italy90_1990	GI.1c
EU003580	Korea90_1990	GI.1c
EU003581	NY-01_2001	GI.1a
EU003582	UT-01_2001	GI.1a
EU871528	RCV-A1_Australia_2007	GI.4
GQ166866	MRCV_USA_2001	GI.3
HM623309	NJ-2009_China_2009	GI.1a
JF412629	HYD_China_Heilongjiang_2005	GI.1a
JF438967	CB156_Portugal_1997	GI.1b
JX886001	CB194_Portugal_2006	GI.1b

JX886002	CB137_Portugal_1995	GI.1b
KF442961	Algarve1_Portugal_2013	GI.2
KF442962	Algarve3_Portugal_2013	GI.2
KF442963	7-13Barrancos_Portugal_2013	GI.2
KF442964	10A13Barrancos_Portugal_2013	GI.2
KF594473	Czechoslovakia-V351_1987	GI.1c
KF594474	Turretfield_06_Australia_2006	GI.1c
KF594475	Turretfield_07_Australia_2007	GI.1c
KF594476	Turretfield_09_Australia_2009	GI.1c
KF677011	STR2012_Poland/2012	GI.1a
KJ606958	Gungahlin_Australia_1998	GI.1c
KJ606959	Parkwood_Australia_1998	GI.1c
KJ943791	P95_Portugal_1996	GI.1b
KM115680	CBEstoi13-7_Portugal_2013	GI.2
KM115681	CBEstremoz14-1_Portugal_2014	GI.2
KM115682	CBEstremoz14-3_Portugal	GI.2
KM115683	CBMora14-1_Portugal	GI.2
KM115689	CBMontemor14-1_Portugal_2014	GI.2
KM115697	CBCoruche14-1_Portugal	GI.2
KM115698	CBCoruche14-2_Portugal_2014	GI.2
KM115711	CBLavra10-13-1_Portugal_2013	GI.2
KM115712	CBMert14-1_Portugal_2014	GI.2
KM115713	CBMert14-2_Portugal_2014	GI.2
KM115714	CBAlgarve14-1_Portugal	GI.2
KM115715	CBAlgarve14-3_Portugal	GI.2
KM115716	CBAlgarve14-4_Portugal	GI.2
KM878681	N11_Spain_2011	GI.2
KM979445	CBVal16_Portugal_2012	GI.2
KP090974	CB110_Portugal_1994	GI.1b
KP090975	CB154_Portugal_1997	GI.1b
KP090976	CBAnd1_Spain_2012	GI.2
KP129395	Rij06-12_Spain	GI.2
KP129396	Seg08-12_Spain	GI.2
KP129397	Tar06-12_Spain	GI.2
KP129398	Zar11-11_Spain_2010	GI.2
KP129399	Zar06-12_Spain	GI.2
KP129400	Bar01-11_Spain_2011	GI.1b
KP144789	Pd_Poland/1989	GI.1c
KP144790	KGM_Poland/1988	GI.1c
KP144792	BLA_Poland/1994	GI.1d
KT006721	NZL/Canterbury/Lincoln/517/2013	GI.1c
KT006722	NZL/Canterbury/MackenzieBasin/95/2012	GI.1c
KT006723	NZL/HawkesBay/BoundaryStream/94/2012	GI.1c
KT006724	NZL/Canterbury/Hawarden/320/2013	GI.1c
KT006725	NZL/Otago/Queensberry/74/2013	GI.1c
KT006726	NZL/Otago/Taras/61/2014	GI.1c
KT006727	NZL/Otago/Luggate/67/2014	GI.1c
KT006728	NZL/Otago/Alexandra/64/2014	GI.1c
KT006729	NZL/Otago/Wanaka/63/2014	GI.1c
KT006730	NZL/Canterbury/MackenzieBasin/322/2013	GI.1c
KT006731	AUS/NSW/Hall/WAT1-13/2007	GI.1c
KT006732	AUS/NSW/Murrumbateman/BlueGums/2014	GI.1c
KT006733	AUS/WA/Gnowangerup/1999	GI.1c

KT006734	AUS/SA/FlindersRanges/1999	GI.1c
KT006735	AUS/WA/Bunbury/2000	GI.1c
KT006736	AUS/SA/Robe/2000	GI.1c
KT006737	AUS/SA/FlindersRanges/2002	GI.1c
KT006738	AUS/SA/OneTreeHill/2003	GI.1c
KT006739	AUS/SA/Coorong/2004	GI.1c
KT006740	AUS/SA/BillaKallina/2004	GI.1c
KT006741	AUS/SA/Woodcroft/2005	GI.1c
KT006742	AUS/SA/FlindersRanges/2006	GI.1c
KT006743	AUS/TAS/SouthArm/2007	GI.1c
KT006744	AUS/SA/Hillbank/2008	GI.1c
KT006745	AUS/SA/Bulgania/2009	GI.1c
KT006746	AUS/WA/WonganHills/2012	GI.1c
KT006747	AUS/NSW/Grafton/2013	GI.1c
KT280058	BlueGums-2_Australia_2015	GI.1c
KT280059	BLMT-2_Australia_2015	GI.1c
KT280060	BLMT-1_Australia_2015	GI.2
KT344770	AUS/CSIRO/Master	GI.1c
KT344771	AUS/CSIRO/Working	GI.1c
KT344772	AUS/CSIRO/Release	GI.1c
KT344773	AUS/EMAI/Batch-1A	GI.1c
KT344774	AUS/EMAI/Batch-1D	GI.1c
KT344775	NZL/V351/Control	GI.1c
KX357653	AUS/ACT/AIN-1/2009	GI.1c
KX357654	AUS/ACT/AIN-2/2009	GI.1c
KX357655	AUS/ACT/Gudg-26/2013	GI.4
KX357656	AUS/ACT/Gudg-79/2014	GI.4
KX357657	AUS/ACT/Gudg-89/2014	GI.4
KX357658	AUS/ACT/GUN_1-240/2012	GI.4
KX357659	AUS/ACT/GUN_1-29/2008	GI.4
KX357660	AUS/ACT/GUN-121/2010	GI.4
KX357661	AUS/ACT/GUN-159/2011	GI.4
KX357662	AUS/ACT/GUN-160/2011	GI.4
KX357663	AUS/ACT/GUN-238/2012	GI.4
KX357664	AUS/ACT/GUN-343/2014	GI.4
KX357665	AUS/ACT/GUN1-11/2007	GI.4
KX357666	AUS/ACT/GUN1-22/2008	GI.4
KX357667	AUS/ACT/GUN1-37/2009	GI.1c
KX357668	AUS/ACT/GUN1-52/2009	GI.1c
KX357669	AUS/ACT/GUN1-60/2010	GI.4
KX357670	AUS/ACT/MtPt-2/2010	GI.1c
KX357671	AUS/ACT/MtPt-4/2010	GI.1c
KX357672	AUS/ACT/PI-1/2009	GI.1c
KX357673	AUS/NSW/BUR1-1/2007	GI.4
KX357674	AUS/NSW/CAT_2-12/2007	GI.4
KX357675	AUS/NSW/CAT_3-4/2007	GI.4
KX357676	AUS/NSW/LWR-1/2010	GI.4
KX357677	AUS/NSW/M2/2007	GI.1c
KX357678	AUS/NSW/M9/2007	GI.1c
KX357679	AUS/NSW/MIC3-3/2007	GI.4
KX357680	AUS/NSW/MIC5-8/2007	GI.4
KX357681	AUS/NSW/OAK_NT-12/2011	GI.4
KX357682	AUS/NSW/OC-13/2007	GI.4

KX357683	AUS/NSW/OC-15/2007	GI.4
KX357684	AUS/NSW/OC-18/2007	GI.4
KX357685	AUS/NSW/OC-20/2007	GI.4
KX357686	AUS/NSW/OC-26/2007	GI.4
KX357687	AUS/NSW/OC-33/2007	GI.4
KX357688	AUS/NSW/OC-36/2007	GI.4
KX357689	AUS/NSW/OC-39/2007	GI.4
KX357690	AUS/NSW/OC-7/2007	GI.4
KX357691	AUS/NSW/V-4/2007	GI.4
KX357692	AUS/NSW/V-5/2007	GI.4
KX357693	AUS/NSW/V-8/2007	GI.4
KX357694	AUS/NSW/WAU-1/2009	GI.4
KX357695	AUS/SA/OR383/2008	GI.1c
KX357696	AUS/VIC/BEN-10/2009	GI.4
KX357697	AUS/VIC/BEN-115/2010	GI.4
KX357698	AUS/VIC/BEN-124/2010	GI.4
KX357699	AUS/VIC/BEN-35/2009	GI.4
KX357700	AUS/VIC/BEN-52/2010	GI.4
KX357701	AUS/VIC/BM-2/2007	GI.4
KX357702	AUS/VIC/BM-35/2009	GI.4
KX357703	AUS/VIC/BM-45/2009	GI.4
KX357704	AUS/VIC/BM-49/2009	GI.4
KX357705	AUS/VIC/BM-60/2009	GI.4
KX357706	AUS/WA/B.Hill/2013	GI.1c
KX357707	NZ/Southland/Gore-425A/2013	GI.4
KY235675	QC/Canada/WIN-AH-2016-OTH-0018_2016	GI.2
KY235676	MB/Canada/WIN-AH-2011-OTH-026_2011	GI.1a
KY235677	Mexico/2718_Mexico	GI.1c
KY235678	Korea/2719_Korea	GI.1c
KY622127	P158_Portugal_1998	GI.1d
KY622128	P165_Portugal_1998	GI.1d
KY622129	P175_Portugal_1999	GI.1a
KY765609	P16_Portugal_1994	GI.1b
KY765610	P19_Portugal_1994	GI.1b
KY765611	P30_Portugal_1994/1995	GI.1b
LT168844	13-165_France_2013	GI.2
M67473	FRG_Germany_1989	GI.1c
MF407651	CBPico17-1_Portugal_2017	GI.2
MF407652	CBPico17-2_Portugal_2017	GI.2
MF407653	16PLM1_Spain_2016	GI.2
MF407654	PSM2_Portugal_2016	GI.2
MF407655	CBMad17-1_Portugal_2017	GI.2
MF407656	CBMad17-2_Portugal_2017	GI.2
MF407657	CBMad17-3_Portugal_2017	GI.2
MG602005	BBI_Poland_Mazowieckie	GI.1a
MG602006	RED2016_Poland_Lodzkie	GI.2
MG602007	VMS_Poland_West Pomeranian	GI.2
MG763936	SOS089_Portugal_2014	GI.2
MG763937	SOS125_Portugal_2014	GI.2
MG763938	SOS129_Portugal_2014	GI.2
MG763939	SOS133_Portugal_2014	GI.2
MG763940	SOS137_Portugal_2015	GI.2
MG763941	SOS140_Portugal_2015	GI.2

MG763942	SOS148_Portugal_2015	GI.2
MG763943	SOS149_Portugal_2015	GI.2
MG763944	SOS150_Portugal_2015	GI.2
MG763945	SOS151_Portugal_2015	GI.2
MG763946	SOS155_Portugal_2015	GI.2
MG763947	SOS158_Portugal_2015	GI.2
MG763948	SOS164_Portugal_2015	GI.2
MG763949	SOS173_Portugal_2015	GI.2
MG763950	SOS404_Portugal_2015	GI.2
MG763951	SOS468_Portugal_2015	GI.2
MG763952	SOS473_Portugal_2015	GI.2
MG763953	SOS474_Portugal_2015	GI.2
MG763954	SOS492_Portugal_2016	GI.2
MN061492	NL2016_Netherlands	GI.2
U54983	RHDV-V351_1987	GI.1c
X87607	BS89_Italy_1989	GI.1d
Z29514	SD_France_1989_	GI.1b
Z49271	RHDV-AST89_1989	GI.1b
MN737113*	10-28_France_2010	GI.2
MN737114*	10-32_France_2010	GI.2
MN737115	06-11_France_2006	GI.3
MN737116*	JA34/09-48_France_2009	GI.3
MN737117*	CHA20/09-100_France_2009	GI.3
MN746289*	BO25/08-133_France_2008	GI.3
MN746288*	JA10/08-10_France_2008	GI.3
MN738377*	16-35_France_2016	GI.2
MN786321*	16-36_France_2016	GI.2

*strains obtained in this study.

Figure. Tanglegram for p16 and non-structural genes except p16 (NSP-p16) of the 221 lagovirus sequences. Colouring of the sequences is according to the genotype to which the strains belong to for the structural genes: GI.1 (red); GI.2 (green); GI.3 (blue); GI.4 (purple); MRCV (yellow). Lines highlight the recombinants at the p16/p23 boundary. Sequences obtained in this study appear in bold.

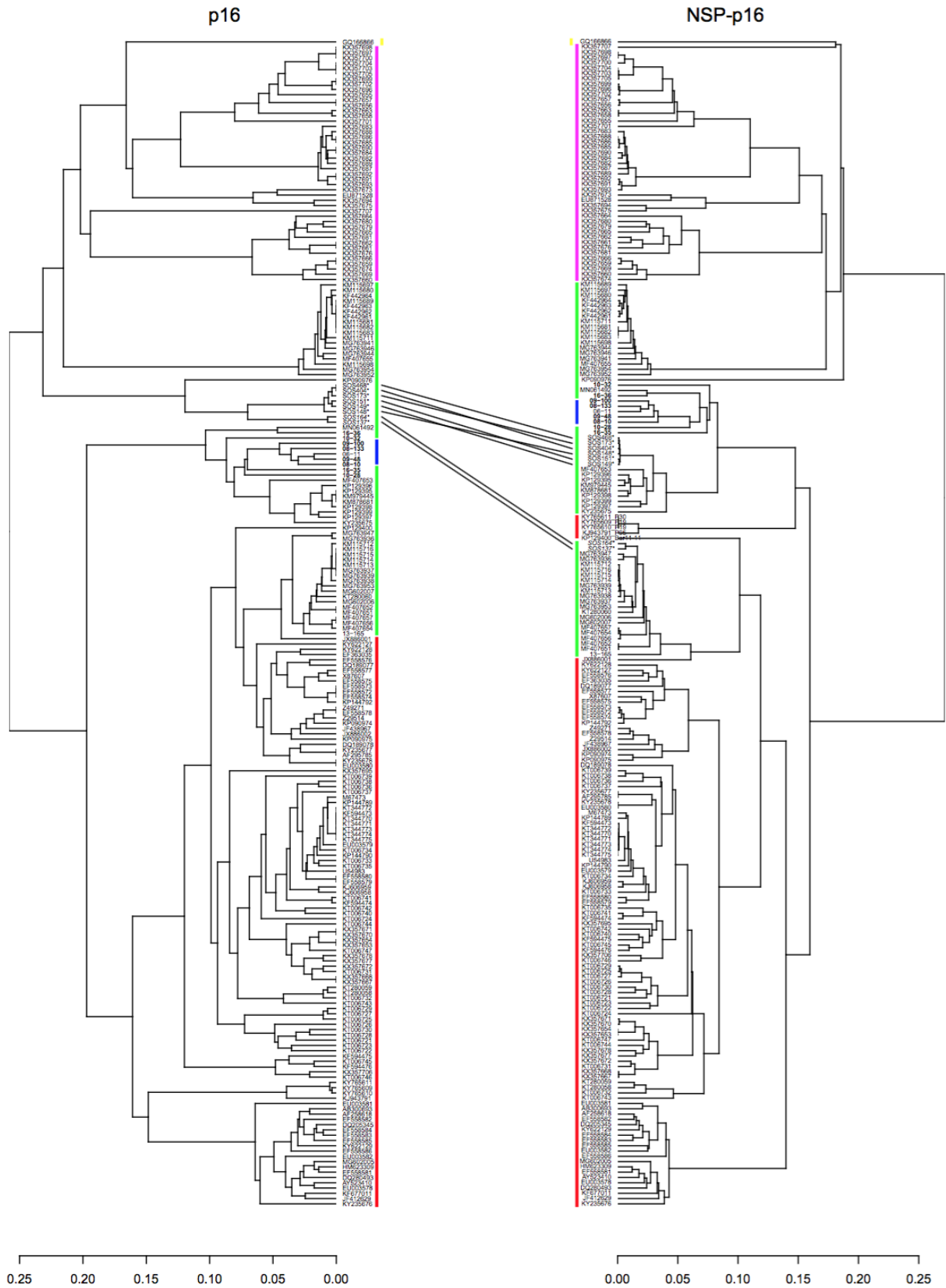


Table. Results of the RDP recombination analysis at the p16/p23 boundary.

Strains	Recombination breakpoint (nucleotide positions) ^a	Most likely donor strain		Methods and average p-value						
		p16	Non-structural proteins	RDP	GENECONV	BootScan	MaxChi	Chimaera	SiScan	3Seq
SOS137, SOS164	Undetermined-369 (355-374)	SOS173 (GI.4)	CBA Algarve14-3 (GI.1b)	2.417x10 ⁻³⁴	1.219x10 ⁻²⁸	7.549x10 ⁻³⁴	5.432x10 ⁻⁸	5.017x10 ⁻⁸	2.925x10 ⁻⁷	1.489x10 ⁻¹⁸
SOS148, SOS149, SOS151, SOS173, SOS404, SOS468	112-447 (446-470)	CBAnd1 (GI.4)	Seg08-12 (GI.3)	1.341x10 ⁻²⁸	3.518x10 ⁻¹³	1.393x10 ⁻²⁹	1.711x10 ⁻⁸	3.928x10 ⁻⁸	1.351x10 ⁻³	1.238x10 ⁻¹²

^a 99% confidence interval.

Figure. ML tree for the structural gene p16 (n=221 sequences; nucleotides 1-429; nucleotide substitution model K2+Γ4). Sequences obtained in this study appear in bold and * mark the recombinants at the p16/p23 boundary.

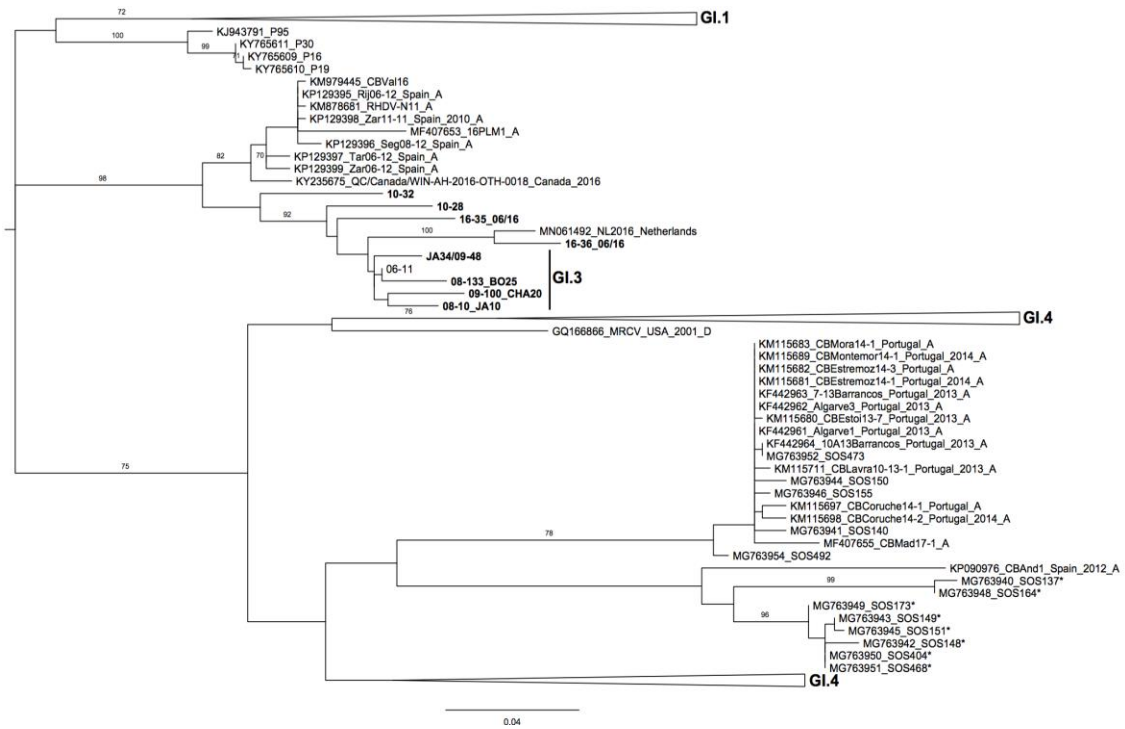


Table. Summary of the genomic composition of the GI.2 strains.

Strains	Genomic partition		
	p16	NSP-p16*	SP**
10-28, 10-32, 16-35, 16-36 (France, 2010 and 2016); N11, Zar11-11, Tar06-12, Zar06-12, Rij06-12, Seg08-12 (Spain, 2011-2012); CBVal16 (Portugal, 2012); 16PLM1 (Canary Islands, Spain, 2016); RHDV2-NL2016 (Netherlands, 2016); QC/Canada/WIN-AH-2016-OTH-0018 (Canada, 2016)	GI.3	GI.3	GI.2
CBAnd1 (Spain, 2012); Algarve1, Algarve3, 7-13_Barrancos, 10A13_Barrancos, CBEstoi13-7, CBEstremoz14-1, CBEstremoz14-3, CBMora14-1, CBMontemor14-1, CBCoruche14-1, CBCoruche14-2, CBLavra10-13-1, CBMad17-1, SOS140, SOS150, SOS155, SOS473, SOS492 (Portugal, 2013-2017)	GI.4	GI.4	GI.2
13-165 (France, 2013); CBMert14-1, CBMert14-2, CBAlgarve14-1, CBAlgarve14-3, CBAlgarve14-4, SOS089, SOS125, SOS129, SOS133, SOS158, SOS474, PSM2, CBPico17-1, CBPico17-2, CBMad17-2, CBMad17-3 (Portugal, 2014-2017); BLMT-1 (Australia, 2015); RED2016_Poland_Lodzkie_Set-2016, VMS_Poland_West Pomeranian_Jun-2017 (Poland 2016-2017)	GI.1b	GI.1b	GI.2
SOS137, SOS164 (Portugal, 2015)	GI.4	GI.1b	GI.2
SOS148, SOS149, SOS151, SOS173, SOS404, SOS468 (Portugal, 2015)	GI.4	GI.3	GI.2
AUS/NSW/2016_10_10/CAR-3 (Australia, 2016)	GI.1a	GI.1a	GI.2

* Non-structural proteins other than p16.

** Structural proteins.