

Supplementary Figure S3. A Clustal X multiple sequence alignment of the polypeptides encoded in ORF2a (S proteins) of the mesoniviruses. A predicted signal peptide in MenoV and predicted transmembrane domains in all mesoniviruses are shaded in aqua, predicted N-glycosylation sites are shaded in green, cysteine residues are shaded in yellow and the sites of proteolytic cleavage to generate glycoproteins S1 and S2 and the unidentified N-terminal fragment are shaded in purple.

HouV (V3982)	MINS-KCPLLFQTTTTSMPNQARRNRS	GPPKILKTEMQWHQNHNA	NAS	SS-----SSKLHRSPLDNHPQ-----DNQNLNATNL
NDiV	MINS-KCPLLFQTTTTSMPNQAHNRNRP	GPPPIILKPETQWHQNHNA	NAS	SS-----SSKLHRSPLNNHPK-----DNQNLNATNL
NgeV (JKT_9982)	MINS-KCPLLFQTTTTSKPNQAHNRNRP	GPPPIILKPETQWHQNHNA	NAS	SS-----SSKLHRSPLNNHPQ-----DNQNLNATNL
CavV	MINS-ICQLQFQTPPTPMPNQALRNKT	GPPKILKPEMQWHQNHNA	NAN	SR-----SSSQHSHNLNNYHHQ-----ERQKNKATNL
KPhV (KP84_156)	MINS-KCQLTLRLPITQQPNKAPRS	-PDNLKILTTVMPLQNPN	AKANSKTTLSSKTRLNSRINNKNKS	SRTVPISKQNHVDVLS
HanaV	MISS-QCQLLPTRTRTTTKPSQAPHVKISSQKPLT	-EMQWLQNR	NASANKT	-----IQQHHQNKHPQ-----VNLNKIAT
BBaV (JKT_9876)	MINSTKCPPLTLRPTTLMPIKAPRSKTVHHQTL	LITEMPRHQNLNAKASSRTNRLINANPISK	TNSKNSKNTNKVKPQQANLKRSV	
KSaV (JKT_10701)	MINSTKCPPLTLRPTTSMPNKAPRSKTVHHQTL	LITEMPRHQNLNAKASSRINRLTKTSLNSKNTSKNK	NKT	SKINLQQVSLRQSV
NseV	MITS-PCRLQFHKIQLKLA	PRNKANKTQTTEQTNPC	CHSDAILIETLG	-----THNNQMLVRVCALNRIEQQAKPELVKH
MenoV	MITL-KC	LLLITHLMLETAQASLSKINNLRIGFSKTP	NKSVNLS	TPFLA-----IEMGKPEAPIINQLRISQQTNP
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HouV (V3982)	MLQHPLSLRSRKQLQQAPTTPKPAVNFT	KSEKNSMLET	TWDGGMKRLDQ	QSSSSSLNLKWHPELTKSII
NDiV	MLQHPLSLRSRKQLQQAPTTPKPAVNFT	KSEKNSMLET	TWDGGMKRLDQ	QSSSSSLNLKWHPELTKSTIA
NgeV (JKT_9982)	MLQHPLSLRSRKQLQQAPTTPKPAVNFT	KSEKNSMLET	TWDGGMKRLDQ	QSSSSSLNLKWHPELTKSTIA
CavV	MLQHQRSLRLRKQLQQVPTTLKPMVNST	KSEKNSMLET	IWDGGMKRLAQ	QSSSFYSNPKWHHELT
KPhV (KP84_156)	ILHKICSSRLRNPLRQAPTTPKPMVNST	KLEKNSMLET	IWDGERMKRLDQ	SSSSSLNLKWHPELTKSITVINSK
HanaV	HLRPHNSLRSRKQLQQAPTTPKLMENC	KSEKNSMQET	IWDGDVMKRLDQ	PSSSSSLNQKWLPELTRC
BBaV (JKT_9876)	NQITMQSSQKLKSLHLAPTSPNPMVSATKSDLN	IT	HETSWDGERMKRLDQ	VSSSSSSQKWYPALTKSTIGVKLK
KSaV (JKT_10701)	NRTIQQSNQKLRNLQSVPTTPNPMVSAT	RSDLNIMHETT	WDGERTKRLDQ	VSSSSSSNQKWYPGLIKSTIGVNLK
NseV	QINPRPTRKQKQLPQAQITPKPMVSDIK	SEKNSMLAT	IWDGDAMRKQDHQ	SSSSSLNQKWLPELTRFITAVNLR
MenoV	MVNPS	S-----QPQLVPTTQR	PKESFTKLEPSLMLET	TWDGDVTRKMDPLYNSSSQKWPELTKLT
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HouV (V3982)	VLAYLFKTPQLSAMQFTTTKNSLLKKKMSMFVNYLT	TPSMQSSCVHV	KHLTLVPFLLLLLMLP	-NANCSTRID
NDiV	VLAYLFKTPQLSAMQFTTTKNSLLKKKMSMFVNYLT	TPSMQSSCVHV	KHLTLVPFLLLLLMLP	-NANCSTRID
NgeV (JKT_9982)	VLAYLFKTPQLSAMQFTTTKNSLLKKKMSMFVNYLT	TPSMQSSCVHV	KHLTLVPFLLLLLMLP	-NANCSTRID
CavV	VLAYLFKTPQLSAMQFTTIPNSLPKKKMSMFVNYPT	TPSMQSSCVHV	KPLTLVHFLLLLLMLP	-NAHCSTRID
KPhV (KP84_156)	VLEYLFKIQPLSVMQFSITKN	SPMKKRMSTYENYQ	MPMSMQSSC	ALAKLLVLVPFLLLLLMLP
HanaV	VLAYLFKIQPLNAMQFTIMQNSLLKKRMSMFVNYQ	MPMSMQFSC	VRAKLLIPML	CLISLLTLP-NVECSTRID
BBaV (JKT_9876)	VLVYLFKTPQSNATQ	SSTMQTSRTT	RSPTTSKTYLTHSMQ	FFSAHAMPLNLVPY
KSaV (JKT_10701)	VLAYLFRTQNLNETQ	SLLTQTSRTT	RSQNTFINYLHMSMQ	SFSVHATPFNLAPY
NseV	GLGSLFKILL	SAMRSLNIQLFQRRKRENTYVNSP	MPSTPSYCA	HATPSKLQLS
MenoV	RSASLSKIP	PLLAMPS	SLPKTSNQMKRMPTYSTFLTHSTQ	SSLAPRLHSILIHSL
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HouV (V3982)	LIVVDDFLKTTLKYNFGTDLYNSA	INYKTSFEQLLN	NFKTPYQPLVDA	FRVLSYLGIEPVA
NDiV	LIVVDDFLKTTLKYNFGTDLYNSA	INYKTSFEQLLN	NFKTPYQPLVDA	FRVLSYLGIEPVA
NgeV (JKT_9982)	LIVVDDFLKTTLKYNFGTDLYNSA	INYKTSFEQLLN	NFKTPYQPLVDA	FRVLSYLGIEPVA
CavV	LIAVDDFLKTTLKYNFGTDLYNSA	INYKTSFEQLLN	NFKTPYQPLVDA	FRVLSYLGIEPVA
KPhV (KP84_156)	LIVVDDFLKTTLKYNFGTDLYNSA	INYKTSFEQLLN	NFKTPYQPLVDA	FRVLSYLGIEPVA
HanaV	LIVVDDFLKTTLKYNFGTDLYNSA	INYKTSFEQLLN	NFKTPYQPLVDA	FRVLSYLGIEPVA
BBaV (JKT_9876)	LIVVDDFLKTTLKYNFGTDLYNSA	INYKTSFELLN	NFKTPYQPLVDA	FILSYLGITPVSH
KSaV (JKT_10701)	LIVVDDFLKTTLKYNFGTDLYNSA	INYKTSFELLN	NFKTPYQPLVDA	FILSYLGITPVSH
NseV	LIVVDDFLKTTLRYNFGSDLYNSA	INYKTSFEQLLN	SFRTPYQPLVEA	FAHVLFGYLG
MenoV	LIAVDDFLKTTLKYNFGTDLYSSA	IKYKESFEQ	LALNFRTPYQPLIEA	FRVLSYLGITPV
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HouV (V3982)	GDVTTIGEHFQEILEDGNLE	LEPLASYWLRHTEDIFVY	TRSQWLWAFICP	SEFAQASIFL
NDiV	GDVTTIGEHFQEILEDGNLE	LEPLASYWLRHTEDIFVY	TRSQWLWAFICP	SEFAQASIFL
NgeV (JKT_9982)	GDVTTIGEHFQEILEDGNLE	LEPLASYWLRHTEDIFVY	TRSQWLWAFICP	SEFAQASIFL
CavV	GSLT-IGEHFQKVLD	DGEFELEPLASYWLRHTEDIS	IYTRSQWLWAFICP	SEFAQASIFL
KPhV (KP84_156)	GDVTTIGEHFQEILEDGNLE	LEPLASYWLRHTEDIFVY	TRSQWLWAFICP	SEFAQASIFL
HanaV	GDVTTIGEHFQEILEDGNLE	LEPLASYWLRHTEDIFVY	TRSQWLWAFICP	SEFAQASIFL
BBaV (JKT_9876)	SNVTIGAHFTKILEDGDL	MEPLASYWLRHTDDIHVY	TRSQWLWAFICP	SEFAPASIFL
KSaV (JKT_10701)	GDVTTIGAHFTKILEDGDL	KMEPLASYWLRHTEEI	IVYTRS	SHLWAFICP
NseV	GDVTTIGEHFQSILDDGNL	QLEPLASYWLRHTEDIFVY	TRSQWLWAFICP	TEYAQANMFL
MenoV	SPIQTIGQIFEEIITEG	SYEYALASYWLTHIED	LKFLTRQQVWAFICP	SEFAQASIFL
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HouV (V3982)	AFN---AEIC	NKVNFI	TPAKANKRSKRWDSS	YVCGWPLVSSA
NDiV	AFN---AEIC	NKVNFI	TPAKAKRSKRWDSS	YVCGWPLVSSA
NgeV (JKT_9982)	AFN---AEIC	NKVNFI	TPAKAKRSKRWDSS	YVCGWPLVSSA
CavV	AQN---AEIC	NKVNFI	TPAKAKRSKRWDSS	YVCGWPLVSSA
KPhV (KP84_156)	AFN---AEIC	NKVNFI	VPKSKRTKRWDSS	YVCGWPLVSSA
HanaV	DFN---AEIC	NKVNFI	TPAKAKRHRWDSS	YVCGWPLVSSA
BBaV (JKT_9876)	DPE---AEV	CNKVNFI	TPKRAQSRKRWDSS	YVCGWPLVSSA
KSaV (JKT_10701)	NPD---AEV	CNKVNFI	TPELAQSRKRWDSS	YVCGWPLVSSA
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NseV SFN--GEI CDKVNFIPTQSKIRKRWDSSYVGWPLVSSAAKVFGGCTTNIDVDLSLKSLTSMQQFSNNANSELIQNLSQL
MenoV SYNDTSYQVCNKVNFLVLKAENRRQRKRWSSSYVGWPLVSSAAKVLGGECTTNIDVDLSLKSNLHAIQNFSLQNTELIHNLQEQL
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HouV (V3982) SVVNARTNLHYNQQLLVTAINDHQAKYVNDINNLINHKNNTNTMENRININSIIIMS YTNLSLFRVYQNI VDYRFAYIETLSS
NDiV SVVNARTNLHYNQQLLVTAINDHQAKYVNDINNLINHKNNTNTMENRINVNS-IIMS YTNLSLFRVYQNI VDYRFAYIETLSS
NgeV (JKT_9982) SVVNARTNLHYNQQLLVTAINDHQAKYVNDINNLINHKNNTNTMENRINVNS-IIMS YTNLSLFRVYQNI VDYRFAYIETLSS
CavV SVVNARTNLHYNQQLLVTAINDHQAKYVTDINNLINHIENTNTLENRINVNS-IIMS YTNLSLFRVYQNI VDYRFAYIETLSS
KPhV (KP84_156) SVVNARTNLHYNQQLKQLVSAINDHQAKYVNDINNLINHQNNTNTLENRINVNS-IIMS YTNLSLFRVYQNI VDYRFAYIETLSS
HanaV SVVNARTNLHYNQQLLVTAINEHQIKYVNDINHLISEIKNTNTLESRIAINS-IIMS YTNLSLFRVYQNI VDYRFAYIETLSS
BBaV (JKT_9876) SVVNARTNLHYNQQLLVTDINEHQIKYVTDINNLISQIRNNTRMKARVSINS-IIMS YTNLSLFRVYQNI VDYRFAYIETLSS
KSaV (JKT_10701) SVVNARTNLHYNQQLLVTAINEHQSKYSVDINNLISQIRNNTRMKARVSINS-IIMS YTNLSLFRIYQNI VDYRFAYIETLSS
NseV TIVNARTNLHYKQLQQLLVTAINSHQERYISDINNLEQVKNTTNSLESRSISINS-IISSYTSSLFRVYQTIVDYRFAYIETLNS
MenoV TIVNARTNLHYNQQLLVNDINN HQARY IADINN LIEQVRNTTNVQTSQININS-IILSYTNSLFRVYQTIVDYRFASYIETLNS
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HouV (V3982) IQQHYHFPSEHLHAFNVLPQAKLREHGFSIPIDSNIPYSYGKVRYLNVGTGINFYDLEFDIYIPVIKLIHEKDSNYHHSTLSAL
NDiV IQQHYHFPSEHLHAFNVLPQAKLREHGFSIPIDSNIPYSYGKVRYLNVGTGINFYDLEFDIYIPVIKLIHEKDSKYHHSTLSAL
NgeV (JKT_9982) IQQHYHFPSEHLHAFNVLPQAKLREHGFSIPIDSNIPYSYGKVRYLNVGTGINFYDLEFDIYIPVIKLIHEKDSNYHHSTLSAL
CavV IQQHYHFPSEHLHAFNSPLQAKLKEHGFSIPIDTNVPYSYGKVRYLNVGTGINFYDLEFDIYIPVIKLIHEKDSKYFHSTLSAL
KPhV (KP84_156) IQQHYHFPSEHLHAFNIPLQSKLKEHGFKIPIIESNIPYSYGKVRYLNVGTGINFYDLEFDIYIPVIKLIHEKDSNFYHSTLSAL
HanaV IQQHYHFPSEHLHAFNRLLDKLKAHGFSIPIDSNIPYSYGKVRYLNVGTGINFYDLEFDIYIPVIKLIHEKDSNYHHSTLSAL
BBaV (JKT_9876) IQEHYHFPSEHLQAFNIPLLAKLREHGFSIPIMNSNIPYSYGKVRYLNVSGINFYDLEFDIYIPVIKLPHENDSYFHSSTLSAL
KSaV (JKT_10701) IQEHYHFPSEHLQAFNIPLLTAKLREHGFSIPIMNNIPYSYGKVRYLNVGTGINFYDLEFDIYIPVIKLPHENDSYFHSSTLSAL
NseV IQQHYHFPSEHMRSFNSDLINKLKAGFTIPVIDSNIPYSYGKVRYLNVGTGINFYDLEFDIYIPTKLSHVNNDNFFYYSTLSAL
MenoV IQQHYHFPSEHMSFNQELLDKLKAGFTIPIIGNYPYSYGVVRYLNVGTGINFYDLEFDVYIPTRIHYEYDTKYWHSTLSAL
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HouV (V3982) PIGINTTLVTYNTYQGNAICTDTYCLESPI NGFCREGESYWYCGGHYIRTLHKITSLSLYTKPTKFTE SAMFI PPHTMYFVHNNTTY
NDiV PIGINTTLVTYNTYQGNAICTDTYCLESPI NGFCREGESYWYCGGHYIRTLHKITSLSLYTKPTKFTXSAMFI PPHTMYFVHNNTTY
NgeV (JKT_9982) PIGINTTLVTYNTYQGNAICTDTYCLESPI NGFCREGESYWYCGGHYIRTLHKITSLSLYTKPTKFTE SAMFI PPHTMYFVHNNTTY
CavV PIGINNTLVITYNTYQGNAICTDTYCLESPI NGFCREGESYWYCGGHYIRTLHKITSLSLRTPKFTDSAMFI PPHTMYFVRNTTY
KPhV (KP84_156) PIGINTSLVTYNTYQGNAICTDTYCLESPI SGFCREGESYWYCGGHYIRTLHKITSLSLYTKPTKFTE SAMFI PPHTMYFVHNNTTY
HanaV PTGTNDSLVTYNTYQGNAICTDTYCLESPI TGFCREGESYWYCGGHYIRTLHKITSLSLYTKPTKFTDSAMFI PPHTMYFVHNNTTY
BBaV (JKT_9876) PVGINNSLVITYNTYQGNAICTDTYCLESPI NGFCHEGEGYWYCGGHYIKTLHKITSLSLYTMPTKFAESAMFI PPHTMYFVHNNTSY
KSaV (JKT_10701) PVGINNTLVITYNTYQGNAICTDTYCLESPI NGFCHEGEGYWYGRHYIKTLHKITSLSLRTPKFAERAMFI PPHTMYFVHNNTSY
NseV PIGINSTHVITYNNYQGS AICTDLYCLETPI NGFCREGGSYWYCGQYVVDTLHKISKLYTSPTEYSAAAMFI PPHTMYFVKNTTY
MenoV PIGINTLHVITYNQYQGS AICTDLYCLETPLTGFCREGENYWYCGGHYIKTLHKITLNLYTNPTKNVQQAMFI PPHTVYFIRNTSY
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HouV (V3982) SLNYG-ASLQALAGSILMLTCNSTVQIPGYSFNANDFVSC TDMNVNVNFIHPSLRVNDANFYIPPTRVDLLEKLYKRDIIPILN
NDiV SLNYG-SSLQALAGSILMLTCNSTVQIPGYNFNSDNDFVSC TDMNVNVNFIHPSLRVNDANFYIPPTRVDLLEKLYKRDIIPILN
NgeV (JKT_9982) SLNYG-SSLQALAGSILMLTCNSTVQIPGYSFNSKD FVSC TDMNVNVNFIHPSLRVNDANFYIPPTRVDLLEKLYKRDIIPILN
CavV SLNHG-SSLQALAGSVLMLCNSTVQIPGYSFNANDFVSC TDMNVNVNFIHPSLRVNDANFYIPPTRVDLLEKLYKRDIPTILK
KPhV (KP84_156) SLNYG-SSLQALAGSILMLTCNSTVQIPGYSFNANDFVSC TDMNVNVNFIHPSLRVNDANFYIPPTRVDLLEKLYKRDIPTILK
HanaV SLNYG-SSLHALAGSVLMLCNSTVQIPGYSFNANDFVSC TDMNVNVNFIHPSLRV NDTNFYIAPTQVDVLEKLYKRDLVPIIK
BBaV (JKT_9876) TINHG-SSLQALAGSVLMMLNCNSTVQISGYSFNSSDFVSC TTMNENNFIHPSLRQSDENFYIPPTRVDLLEKLYTRDVLPIIK
KSaV (JKT_10701) TIDNG-NSLQALAGSVLMMLTCSSTVQISGYSFNASDFVSC TTMNENNFIHPSLRSSDEHFYIPPTRVDLLEKLYTRDVLPIIK
NseV TLNEN-NIYTALTGSVLMMLNCNSTVLVGRNYFN TSDFEVCTNLKNNVFIHNRLNTDPDFYIGPSEINKLENYLDRIDPIIK
MenoV SLNHGPSNSTGLTGSVMMLTCNSSIQIPGVVFNAADFVSCSDITNNNFIHGGLHPDDPNFYTFPSVQQOLEEFYNRDITPIIT
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HouV (V3982) HIQKANDITIDTTADEELKQQYETLKNDFNAKYDALNIENRRIHALINSMHSIQSEPSYILYMVI AVIVFIVL KFLRII
NDiV HIQKANDITIDTTADEELKQQYETLKSDFNAKYDALNIENRRIHALINSMHSIQSEPSYILYMVI AVIVFIVL KFLRII
NgeV (JKT_9982) HIQKANDITIDTTADEELKQQYETLKSDFNAKYDALNIENRRIHALINSMHSIQSEPSYMLYMVI AVIVFIVL KFLRII
CavV HIHKADDITIDTTSDEELKQQYETLKNDEVNAKYDALIENRRIHALINSMHSIQSEASVYLVLVIAVIVFIVL KFLRII
KPhV (KP84_156) HVQ-ANDIVIDTTADEELKQQYETLKNDFNAKYDALNIENRRIHALINSMHSIKSEPSYFLYMVI AVIVFIVL KFLRII
HanaV HIRQYDSIKVDTTADKELQQQYETLKNDFNAKEYAALIAENSRIYTLINSMHSINSESYMMLYLVIAVIVFIVL KFLRII
BBaV (JKT_9876) DIQQDRSITIDTTDDEQLQQYETLKNDFNAKYAALNIENKRIYALINSMHSIHNETSYVLVLVIAVIVFIVL KFLRII
KSaV (JKT_10701) DITODQSITIDTTDDEQLQQYETLKNDFNAKYAALNIENKRIYALINNMHSIHSETSYVLVLVIAVIVFIVL KFLRII
NseV HTNNTVKLRIDTSSDEILNQYATLKDSLETIKILLAGENQRIIATIGNMHAIPTSETPMFYIILGVLLL FVL KFLRII
MenoV NIHN YQDLFIDSSQDKNLTOQQYETLRNDFDMKYKKLL ENQRILQLINNMHSIDSETPIYFIYIIGVLVLFILKFLRII
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