**Supplementary Table 1**  List of sequences used in this study

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| No. | Strain name | GenBank  accession number | Country | Year | Genotype |
|
| 1 | D11-JW-022 | KC851810.1 | South Korea | 2011 | 1 |
| 2 | D11-JW-024 | KC851811.1 | South Korea | 2011 | 1 |
| 3 | D12-KD-019 | KC851819.1 | South Korea | 2012 | 1 |
| 4 | D12-KD-02 | KC851821.1 | South Korea | 2012 | 1 |
| 5 | D12-JW-035 | KC851814.1 | South Korea | 2012 | 1 |
| 6 | D12-JW-047 | KC851815.1 | South Korea | 2012 | 1 |
| 7 | FJFQ315 | GQ423744.1 | China | 2006 | 2 |
| 8 | YS07 | EU344806.1 | China | 2007 | 1 |
| 9 | MH11 | EU344805.1 | China | 2007 | 2 |
| 10 | PT07 | EU499310.1 | China | 2007 | 2 |
| 11 | HZ09 | EU344802.1 | China | 2007 | 2 |
| 12 | MH02/07 | EU499309.1 | China | 2007 | 2 |
| 13 | LJ33 | EU344803.1 | China | 2007 | 1 |
| 14 | FJPT09 | GQ423741.1 | China | 2007 | 2 |
| 15 | WS-GD01 | FJ554673.1 | China | 2008 | 2 |
| 16 | WF0802 | GU131341.1 | China | 2008 | 2 |
| 17 | FJzq290 | GU168779.1 | China | 2008 | 1 |
| 18 | WF0804 | GU131343.1 | China | 2008 | 2 |
| 19 | AQ0901 | GU014543.1 | China | 2009 | 1 |
| 20 | LZ/11 | HQ180265.1 | China | 2009 | 1 |
| 21 | Zhejiang | GQ334371.1 | China | 2009 | 1 |
| 22 | Fujian | HG532019.1 | China | 2010 | 2 |
| 23 | PX08 | KC460533.1 | China | 2011 | 1 |
| 24 | GH01 | JX499186.1 | China | 2012 | 2 |
| 25 | NN12 | KC460531.1 | China | 2012 | 1 |
| 26 | YN24 | KR491945.1 | China | 2013 | 2 |
| 27 | SDFC12 | KY328304.1 | China | 2015 | 1 |
| 28 | JSPX03E | MF627688.1 | China | 2016 | 1 |
| 29 | YF180401 | MN068357.1 | China | 2017 | 1 |
| 30 | WF190501 | MN068359.1 | China | 2017 | 1 |
| 31 | HZ170301 | MN068356.1 | China | 2017 | 1 |
| 32 | SDHZ1223 | MT084134.1 | China | 2018 | 1 |
| 33 | YN180506 | MK814585.1 | China | 2018 | 2 |
| 34 | AHHF1109 | MT084131.1 | China | 2018 | 1 |
| 35 | FJ1815 | MN052853.1 | China | 2018 | 2 |
| 36 | HN07 | MN928801.1 | China | 2019 | 1 |
| 37 | GX190510 | MK814581.1 | China | 2019 | 1 |
| 38 | 33753-52 | DQ100076.1 | USA | 2007 | 1 |
| 39 | VC4 | MT318126.1 | Brasil | 2014 | 1 |
| 40 | TC2 | DQ166836.1 | Taiwan | 2002 | 2 |
| 41 | TC4 | DQ166838.1 | Taiwan | 2002 | 2 |
| 42 | CP12021 | KP229377.1 | Taiwan | 2012 | 2 |
| 43 |  | AY228555.1 | Germany | 2003 | 1 |
| 44 |  | NC\_005053.1 | Germany | 2003 | 1 |

**Supplementary Table 2**  Negative selection in the DuCV capsid protein of

the current six Vietnamese DuCV strains

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Site | α | β | β – α | Prob [α > β] | Prob [α < β] | BayesFactor [α < β] |
|
| 32 | 7.25 | 0.37 | –6.88 | 0.92 | 0.07 | 0.15 |
| 36 | 6.74 | 0.36 | –6.38 | 0.97 | 0.03 | 0.06 |
| 41 | 14.57 | 0.34 | –14.23 | 1.00 | 0.00 | 0.01 |
| 43 | 6.49 | 0.34 | –6.16 | 0.92 | 0.06 | 0.14 |
| 45 | 12.15 | 0.33 | –11.82 | 0.99 | 0.01 | 0.02 |
| 51 | 17.59 | 0.37 | –17.22 | 0.99 | 0.00 | 0.01 |
| 57 | 5.05 | 0.35 | –4.70 | 0.91 | 0.07 | 0.17 |
| 58 | 5.08 | 0.38 | –4.70 | 0.90 | 0.08 | 0.19 |
| 59 | 7.94 | 0.33 | –7.61 | 0.95 | 0.04 | 0.10 |
| 61 | 7.31 | 0.37 | –\6.95 | 0.90 | 0.08 | 0.19 |
| 62 | 6.64 | 0.36 | –6.29 | 0.91 | 0.07 | 0.17 |
| 63 | 14.21 | 0.35 | –13.86 | 0.99 | 0.00 | 0.01 |
| 66 | 6.89 | 0.34 | –6.55 | 0.92 | 0.06 | 0.14 |
| 67 | 16.73 | 0.34 | –16.39 | 0.98 | 0.02 | 0.04 |
| 69 | 16.73 | 0.34 | –16.39 | 0.98 | 0.02 | 0.04 |
| 73 | 6.67 | 0.36 | –6.31 | 0.93 | 0.05 | 0.12 |
| 74 | 5.05 | 0.36 | –4.69 | 0.91 | 0.08 | 0.18 |
| 75 | 12.58 | 0.34 | –12.24 | 0.96 | 0.03 | 0.07 |
| 82 | 28.61 | 1.18 | –27.43 | 0.97 | 0.02 | 0.04 |
| 85 | 8.21 | 0.31 | –7.90 | 0.95 | 0.04 | 0.10 |
| 86 | 6.57 | 0.34 | –6.23 | 0.92 | 0.06 | 0.14 |
| 87 | 9.30 | 0.36 | –8.94 | 0.94 | 0.05 | 0.10 |
| 89 | 7.45 | 0.39 | –7.06 | 0.97 | 0.03 | 0.06 |
| 94 | 6.28 | 0.35 | –5.93 | 0.91 | 0.07 | 0.16 |
| 96 | 9.23 | 0.35 | –8.88 | 0.94 | 0.05 | 0.10 |
| 97 | 6.29 | 0.36 | –5.92 | 0.91 | 0.07 | 0.17 |
| 100 | 9.18 | 0.31 | –8.87 | 0.95 | 0.04 | 0.09 |
| 105 | 6.67 | 0.36 | –6.31 | 0.93 | 0.05 | 0.12 |
| 115 | 8.21 | 0.32 | –7.90 | 0.95 | 0.04 | 0.10 |
| 117 | 9.29 | 0.35 | –8.94 | 0.95 | 0.04 | 0.10 |
| 120 | 10.14 | 0.34 | –9.80 | 0.94 | 0.04 | 0.10 |
| 122 | 5.04 | 0.37 | –4.67 | 0.90 | 0.08 | 0.19 |
| 126 | 5.14 | 0.36 | –4.78 | 0.91 | 0.07 | 0.16 |
| 129 | 7.26 | 0.35 | –6.91 | 0.92 | 0.06 | 0.14 |
| 134 | 6.49 | 0.34 | –6.15 | 0.92 | 0.06 | 0.15 |
| 135 | 6.49 | 0.34 | –6.16 | 0.92 | 0.06 | 0.14 |
| 137 | 6.49 | 0.34 | –6.16 | 0.92 | 0.06 | 0.14 |
| 138 | 5.10 | 0.35 | –4.76 | 0.91 | 0.07 | 0.17 |
| 139 | 13.01 | 0.34 | –12.67 | 0.96 | 0.04 | 0.08 |
| 140 | 8.30 | 0.36 | –7.94 | 0.93 | 0.05 | 0.12 |
| 144 | 6.90 | 0.34 | –6.56 | 0.93 | 0.05 | 0.12 |
| 150 | 13.10 | 0.33 | –12.77 | 0.97 | 0.02 | 0.05 |
| 153 | 12.48 | 0.33 | –12.16 | 0.99 | 0.01 | 0.02 |
| 155 | 6.80 | 0.33 | –6.46 | 0.94 | 0.05 | 0.10 |
| 157 | 11.15 | 0.37 | –10.77 | 0.94 | 0.05 | 0.12 |
| 160 | 6.90 | 0.34 | –6.56 | 0.93 | 0.05 | 0.12 |
| 164 | 12.42 | 0.34 | –12.08 | 0.99 | 0.01 | 0.01 |
| 165 | 8.92 | 0.39 | –8.53 | 0.93 | 0.06 | 0.13 |
| 166 | 14.04 | 0.34 | –13.71 | 0.99 | 0.01 | 0.02 |
| 170 | 9.16 | 0.34 | –8.82 | 0.96 | 0.04 | 0.08 |
| 175 | 6.68 | 0.37 | –6.32 | 0.93 | 0.05 | 0.12 |
| 179 | 7.53 | 0.35 | –7.18 | 0.93 | 0.06 | 0.13 |
| 184 | 6.65 | 0.33 | –6.33 | 0.94 | 0.04 | 0.10 |
| 185 | 24.98 | 0.37 | –24.62 | 1.00 | 0.00 | 0.00 |
| 188 | 6.90 | 0.34 | –6.56 | 0.93 | 0.05 | 0.12 |
| 190 | 32.31 | 0.44 | –31.87 | 1.00 | 0.00 | 0.00 |
| 191 | 26.58 | 0.40 | –26.17 | 1.00 | 0.00 | 0.00 |
| 192 | 12.39 | 0.34 | –12.04 | 0.99 | 0.01 | 0.02 |
| 193 | 14.91 | 0.92 | –14.00 | 0.91 | 0.07 | 0.16 |
| 198 | 6.82 | 0.38 | –6.44 | 0.91 | 0.07 | 0.17 |
| 199 | 8.94 | 0.35 | –8.60 | 0.94 | 0.05 | 0.11 |
| 200 | 9.23 | 0.35 | –8.88 | 0.94 | 0.05 | 0.10 |
| 202 | 12.69 | 0.37 | –12.32 | 0.99 | 0.01 | 0.02 |
| 204 | 16.14 | 0.36 | –15.78 | 0.99 | 0.01 | 0.01 |
| 206 | 17.72 | 0.33 | –17.39 | 0.98 | 0.02 | 0.03 |
| 208 | 8.28 | 0.34 | –7.94 | 0.94 | 0.05 | 0.12 |
| 210 | 6.30 | 0.35 | –5.95 | 0.92 | 0.06 | 0.15 |
| 211 | 9.18 | 0.31 | –8.87 | 0.95 | 0.04 | 0.09 |
| 214 | 13.45 | 0.34 | –13.11 | 0.97 | 0.03 | 0.06 |
| 215 | 17.74 | 0.33 | –17.41 | 0.98 | 0.02 | 0.03 |
| 216 | 13.01 | 0.34 | –12.67 | 0.96 | 0.04 | 0.08 |
| 217 | 7.95 | 0.35 | –7.60 | 0.94 | 0.05 | 0.11 |
| 225 | 8.22 | 0.33 | –7.89 | 0.94 | 0.05 | 0.10 |
| 226 | 15.08 | 0.35 | –14.73 | 1.00 | 0.00 | 0.01 |
| 227 | 6.74 | 0.36 | –6.38 | 0.97 | 0.03 | 0.06 |
| 228 | 28.47 | 0.38 | –28.09 | 1.00 | 0.00 | 0.00 |
| 229 | 7.26 | 0.34 | –6.92 | 0.92 | 0.06 | 0.14 |
| 230 | 9.19 | 0.32 | –8.87 | 0.95 | 0.04 | 0.09 |
| 231 | 9.18 | 0.31 | –8.87 | 0.95 | 0.04 | 0.09 |
| 233 | 8.28 | 0.34 | –7.94 | 0.94 | 0.05 | 0.12 |
| 234 | 11.77 | 0.34 | –11.43 | 0.99 | 0.01 | 0.02 |
| 242 | 19.59 | 0.35 | –19.24 | 0.98 | 0.02 | 0.04 |
| 243 | 10.92 | 0.32 | –10.60 | 0.99 | 0.01 | 0.02 |
| 244 | 6.49 | 0.34 | –6.15 | 0.92 | 0.06 | 0.15 |
| 245 | 9.23 | 0.35 | –8.88 | 0.94 | 0.05 | 0.10 |
| 248 | 8.29 | 0.35 | –7.94 | 0.94 | 0.05 | 0.11 |
| 250 | 6.89 | 0.33 | –6.56 | 0.93 | 0.06 | 0.14 |
| 251 | 10.39 | 0.35 | –10.04 | 0.95 | 0.04 | 0.10 |
| 256 | 15.45 | 0.36 | –15.09 | 0.99 | 0.01 | 0.02 |

α: indicates posterior synonymous substitution rate at a site; β: indicates posterior non-synonymous substitution rate at a site; α > β: negative selection; α < β: positive selection; α = β: neutral selection; Prob[α > β] ≥ 0.9: posterior probability of negative selection at a site; Prob[α < β] ≥ 0.9: posterior probability of positive selection at a site. Eighty-nine negatively selective positions were indicated.

**Supplementary Table 3**  Negative selection in the DuCV replication protein

of the current six Vietnamese DuCV strains

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Site | α | β | β – α | Prob [α > β] | Prob [α < β] | BayesFactor [α < β] |
|
| 2 | 12.12 | 0.55 | –11.57 | 0.92 | 0.07 | 0.13 |
| 4 | 19.34 | 0.52 | –18.82 | 0.95 | 0.04 | 0.07 |
| 8 | 11.14 | 0.54 | –10.61 | 0.91 | 0.08 | 0.15 |
| 10 | 19.25 | 0.60 | –18.65 | 0.95 | 0.04 | 0.08 |
| 13 | 15.74 | 0.54 | –15.20 | 0.91 | 0.07 | 0.13 |
| 15 | 13.05 | 0.50 | –12.55 | 0.92 | 0.06 | 0.12 |
| 24 | 22.89 | 0.55 | –22.34 | 0.97 | 0.02 | 0.04 |
| 39 | 11.90 | 0.54 | –11.36 | 0.92 | 0.06 | 0.12 |
| 44 | 19.25 | 0.63 | –18.62 | 0.94 | 0.05 | 0.09 |
| 50 | 11.30 | 0.53 | –10.77 | 0.91 | 0.07 | 0.14 |
| 69 | 19.25 | 0.63 | –18.62 | 0.94 | 0.05 | 0.09 |
| 85 | 22.95 | 0.56 | –22.39 | 0.97 | 0.02 | 0.04 |
| 108 | 13.32 | 0.56 | –12.76 | 0.90 | 0.08 | 0.15 |
| 124 | 28.23 | 2.41 | –25.82 | 0.96 | 0.02 | 0.04 |
| 129 | 12.11 | 0.59 | –11.52 | 0.91 | 0.07 | 0.14 |
| 134 | 30.27 | 0.48 | –29.78 | 1.00 | 0.00 | 0.00 |
| 152 | 24.67 | 0.55 | –24.12 | 0.99 | 0.01 | 0.01 |
| 153 | 19.25 | 0.63 | –18.62 | 0.94 | 0.05 | 0.09 |
| 154 | 18.54 | 0.51 | –18.03 | 0.94 | 0.04 | 0.08 |
| 155 | 25.09 | 0.56 | –24.53 | 0.97 | 0.03 | 0.05 |
| 160 | 24.60 | 0.52 | –24.08 | 0.99 | 0.00 | 0.01 |
| 161 | 23.26 | 0.57 | –22.69 | 0.96 | 0.03 | 0.06 |
| 162 | 34.33 | 0.57 | –33.76 | 1.00 | 0.00 | 0.00 |
| 168 | 18.50 | 0.47 | –18.03 | 0.95 | 0.04 | 0.08 |
| 169 | 24.61 | 0.48 | –24.13 | 0.99 | 0.01 | 0.01 |
| 170 | 11.06 | 0.65 | –10.41 | 0.90 | 0.08 | 0.15 |
| 177 | 11.47 | 0.53 | –10.94 | 0.91 | 0.07 | 0.13 |
| 213 | 12.10 | 0.48 | –11.62 | 0.92 | 0.06 | 0.12 |
| 216 | 18.87 | 0.56 | –18.31 | 0.95 | 0.04 | 0.08 |
| 218 | 23.63 | 0.54 | –23.09 | 0.99 | 0.01 | 0.01 |
| 219 | 33.37 | 0.59 | –32.78 | 1.00 | 0.00 | 0.00 |
| 224 | 32.70 | 0.56 | –32.14 | 1.00 | 0.00 | 0.00 |
| 229 | 19.41 | 0.63 | –18.77 | 0.94 | 0.05 | 0.08 |
| 230 | 19.35 | 0.48 | –18.87 | 0.94 | 0.05 | 0.09 |
| 237 | 19.18 | 0.48 | –18.70 | 0.96 | 0.03 | 0.06 |
| 238 | 12.11 | 0.59 | –11.52 | 0.91 | 0.07 | 0.14 |
| 241 | 23.75 | 0.52 | –23.23 | 0.99 | 0.01 | 0.01 |
| 245 | 12.70 | 0.53 | –12.17 | 0.92 | 0.06 | 0.12 |
| 249 | 19.41 | 0.63 | –18.77 | 0.94 | 0.05 | 0.08 |
| 254 | 39.91 | 0.57 | –39.34 | 1.00 | 0.00 | 0.00 |
| 260 | 30.28 | 3.49 | –26.79 | 0.93 | 0.05 | 0.09 |
| 261 | 11.14 | 0.54 | –10.61 | 0.91 | 0.08 | 0.15 |
| 262 | 23.92 | 0.53 | –23.39 | 0.99 | 0.01 | 0.01 |
| 263 | 15.40 | 0.65 | –14.76 | 0.97 | 0.02 | 0.04 |
| 266 | 24.73 | 0.96 | –23.77 | 0.95 | 0.05 | 0.09 |
| 272 | 12.11 | 0.59 | –11.52 | 0.91 | 0.07 | 0.14 |
| 281 | 13.44 | 0.51 | –12.92 | 0.92 | 0.06 | 0.12 |
| 283 | 25.19 | 3.30 | –21.89 | 0.93 | 0.04 | 0.08 |
| 287 | 11.72 | 0.48 | –11.24 | 0.92 | 0.07 | 0.13 |

α: indicates posterior synonymous substitution rate at a site; β: indicates posterior non-synonymous substitution rate at a site; α > β: negative selection; α < β: positive selection; α = β: neutral selection; Prob[α > β] ≥ 0.9: posterior probability of negative selection at a site; Prob[α < β] ≥ 0.9: posterior probability of positive selection at a site. Forty-nine negatively selective positions were indicated.