**Virologica Sinica**

**Supplementary Data**

**Combined insertion of basic and non-basic amino acids at hemagglutinin cleavage site of highly pathogenic H7N9 virus promotes replication and pathogenicity in chickens and mice**

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**Supplementary Table S1** The detail information of H7N9 virus used in this study.

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| --- | --- | --- | --- | --- | --- |
| **GISAID number** | **Isolate name** | **Cleavage site motif** | **Collection date** | **Host** | **Province** |
| EPI\_ISL\_249281 | A/Chicken/Heyuan/16876/2016(H7N9) | PEVPKGKRTAR/G | 2016/7/24 | Chicken | Guangdong |
| EPI\_ISL\_258228 | A/Env/GD-HY219/H7N9/2016-11-02 | PEVPKGKRTAR/G | 2016/11/2 | Environment | Guangdong |
| EPI\_ISL\_249310 | A/Environment/Guangdong/C16283222/2016 | PEVPKGKRTAR/G | 2016/11/7 | Environment | Guangdong |
| EPI\_ISL\_258240 | A/Env/GD-MZ110/H7N9/2016-11-07 | PEVPKGKRTAR/G | 2016/11/7 | Environment | Guangdong |
| EPI\_ISL\_258229 | A/Env/GD-HY277/H7N9/2016-12-07 | PEVPKGKRTAR/G | 2016/12/7 | Environment | Guangdong |
| EPI\_ISL\_273856 | A/Environment/Guangzhou/K4072/2016 | PEVPKGKRTAR/G | 2016/12/15 | Environment | Guangdong |
| EPI\_ISL\_273943 | A/Environment/Guangzhou/K4073/2016 | PEVPKGKRTAR/G | 2016/12/15 | Environment | Guangdong |
| EPI\_ISL\_273944 | A/Environment/Guangzhou/K4068/2016 | PEVPKGKRTAR/G | 2016/12/15 | Environment | Guangdong |
| EPI\_ISL\_273945 | A/Environment/Guangzhou/K4075/2016 | PEVPKGKRTAR/G | 2016/12/15 | Environment | Guangdong |
| EPI\_ISL\_273946 | A/Environment/Guangzhou/K4048/2016 | PEVPKGKRTAR/G | 2016/12/15 | Environment | Guangdong |
| EPI\_ISL\_258220 | A/Env/A/GD-JY437/H7N9/2016-12-23 | PEVPKGKRTAR/G | 2016/12/23 | Environment | Guangdong |
| EPI\_ISL\_258241 | A/Env/GD-MZ409/H7N9/2016-12-26 | PEVPKGKRTKR/G | 2016/12/26 | Environment | Guangdong |
| EPI\_ISL\_267751 | A/Environment/Guangdong/02735/2016 | PEVPKGKRTAR/G | 2016/12/26 | Environment | Guangdong |
| EPI\_ISL\_267752 | A/Environment/Guangdong/02736/2016 | PEVPKGKRTAR/G | 2016/12/26 | Environment | Guangdong |
| EPI\_ISL\_267753 | A/Environment/Guangdong/02737/2016 | PEVPKGKRTAR/G | 2016/12/26 | Environment | Guangdong |
| EPI\_ISL\_267754 | A/Environment/Guangdong/02738/2016 | PEVPKGKRTAR/G | 2016/12/26 | Environment | Guangdong |
| EPI\_ISL\_267755 | A/Environment/Guangdong/02739/2016 | PEVPKGKRTAR/G | 2016/12/26 | Environment | Guangdong |
| EPI\_ISL\_267756 | A/Environment/Guangdong/02741/2016 | PEVPKGKRTAR/G | 2016/12/26 | Environment | Guangdong |
| EPI\_ISL\_258243 | A/Env/GD-ZS921/H7N9/2016-12-27 | PEVPKRKRTAR/G | 2016/12/27 | Environment | Guangdong |
| EPI\_ISL\_248796 | A/Chicken/Huizhou/HZ-3/2016(H7N9) | PEVPKRKRTAR/G | 2016/12/28 | Chicken | Guangdong |
| EPI\_ISL\_249114 | A/Chicken/Huizhou/HZ04/2016(H7N9) | PEVPKRKRTAR/G | 2016/12/28 | Chicken | Guangdong |
| EPI\_ISL\_258244 | A/Env/GD-ZS975/H7N9/2016-12-30 | PEVPKRKRTAR/G | 2016/12/30 | Environment | Guangdong |
| EPI\_ISL\_327792 | A/Guangdong/GZ8H001/2017 | PEVPKRKRTAR/G | 2017/1/1 | Human | Guangdong |
| EPI\_ISL\_249309 | A/Guangdong/17SF003/2016 | PEVPKRKRTAR/G | 2017/1/3 | Human | Guangdong |
| EPI\_ISL\_280901 | A/Guangdong/17SF003/2016/-1 | PEVPKRKRTAR/G | 2017/1/3 | Human | Guangdong |
| EPI\_ISL\_280902 | A/Guangdong/17SF003/2016 | PEVPKRKRTAR/G | 2017/1/3 | Human | Guangdong |
| EPI\_ISL\_250311 | A/Guangdong/Th008/2017\_H7N9 | PEVPKRKRTAR/G | 2017/1/4 | Human | Guangdong |
| EPI\_ISL\_256108 | A/Guangdong/HP001/2017 | PEVPKRKRTAR/G | 2017/1/4 | Human | Guangdong |
| EPI\_ISL\_256109 | A/Guangdong/SP440/2017 | PEVPKRKRTAR/G | 2017/1/4 | Human | Guangdong |
| EPI\_ISL\_263365 | A/Guangdong/8H324/2017 | PEVPKRKRTAR/G | 2017/1/4 | Human | Guangdong |
| EPI\_ISL\_273948 | A/Dressed\_chicken/Guangdong/GZ066/2017 | PEVPKGKRTAR/G | 2017/1/4 | Chicken | Guangdong |
| EPI\_ISL\_259758 | A/chicken/Guangdong/01.08\_SZBJ0011-O/2017 | PEVPKRKRTAR/G | 2017/1/8 | Chicken | Guangdong |
| EPI\_ISL\_267757 | A/Environment/Guangdong/07128/2017 | PEVPKGKRTAR/G | 2017/1/9 | Environment | Guangdong |
| EPI\_ISL\_283486 | A/chicken/Guangdong/SD008/2017 | PEVPKGKRTAR/G | 2017/1/9 | Chicken | Guangdong |
| EPI\_ISL\_248886 | A/Chicken/Huizhou/HZX/2017(H7N9) | PEVPKGKRTAR/G | 2017/1/10 | Chicken | Guangdong |
| EPI\_ISL\_249113 | A/Chicken/Zhongshan/ZS/2017(H7N9) | PEVPKRKRTAR/G | 2017/1/12 | Chicken | Guangdong |
| EPI\_ISL\_249308 | A/Guangdong/17SF006/2017 | PEVPKRKRTAR/G | 2017/1/12 | Human | Guangdong |
| EPI\_ISL\_283499 | A/chicken/Guangdong/SD032/2017 | PEVPKGKRTAR/G | 2017/1/12 | Chicken | Guangdong |
| EPI\_ISL\_249102 | A/Qingyuan/GIRD1/2017 | PEVPKRKRTAR/G | 2017/1/14 | Human | Guangdong |
| EPI\_ISL\_257022 | A/Qingyuan/GIRD01/2017 | PEVPKRKRTAR/G | 2017/1/14 | Human | Guangdong |
| EPI\_ISL\_248816 | A/Chicken/Guangzhou/HD621/2017(H7N9) | PEVPKGKRTAR/G | 2017/1/15 | Chicken | Guangdong |
| EPI\_ISL\_696533 | A/goose/Guangdong/Q38/2017 | PEVPKRKRTAR/G | 2017/1/15 | Goose | Guangdong |
| EPI\_ISL\_283487 | A/chicken/Guangdong/SD010/2017 | PEVPKGKRTAR/G | 2017/1/18 | Chicken | Guangdong |
| EPI\_ISL\_283495 | A/chicken/Guangdong/SD027/2017 | PEIPKGKRTAR/G | 2017/1/18 | Chicken | Guangdong |
| EPI\_ISL\_283496 | A/chicken/Guangdong/SD028/2017 | PEVPKGKRTAR/G | 2017/1/18 | Chicken | Guangdong |
| EPI\_ISL\_283498 | A/chicken/Guangdong/SD031/2017 | PEVPKGKRTAR/G | 2017/1/18 | Chicken | Guangdong |
| EPI\_ISL\_283500 | A/chicken/Guangdong/SD034/2017 | PEVPKGKRTAR/G | 2017/1/22 | Chicken | Guangdong |
| EPI\_ISL\_267758 | A/Guangdong/17SF032/2017 | PEVPKRKRTAR/G | 2017/1/23 | Human | Guangdong |
| EPI\_ISL\_250312 | A/Guangdong/Th005/2017\_H7N9 | PEVPKGKRIAR/G | 2017/2/1 | Human | Guangdong |
| EPI\_ISL\_280466 | A/chicken/Guangdong/J1/2017 | PEVPKGKRTAR/G | 2017/2/1 | Chicken | Guangdong |
| EPI\_ISL\_280467 | A/chicken/Guangdong/J2/2017 | PEVPKGKRTAR/G | 2017/2/1 | Chicken | Guangdong |
| EPI\_ISL\_379650 | A/chicken/Guangdong/S10131/2017 | PEVPKRKRTAR/G | 2017/2/7 | Chicken | Guangdong |
| EPI\_ISL\_379651 | A/chicken/Guangdong/S11523/2017 | PEVPKGKRTAR/G | 2017/2/7 | Chicken | Guangdong |
| EPI\_ISL\_379652 | A/chicken/Guangdong/S12178/2017 | PEVPKRRRTAR/G | 2017/2/7 | Chicken | Guangdong |
| EPI\_ISL\_379655 | A/chicken/Guangdong/S12669/2017 | PEVPKGKRTAR/G | 2017/2/7 | Chicken | Guangdong |
| EPI\_ISL\_249307 | A/Chicken/Huizhou/HZL1/2017(H7N9) | PEVPKGKRTAR/G | 2017/2/8 | Chicken | Guangdong |
| EPI\_ISL\_267760 | A/Guangdong/17SF037/2017 | PEVPKRKRAAR/G | 2017/2/9 | Human | Guangdong |
| EPI\_ISL\_269511 | A/Hunan/11026/2017 | PEVPKRKRTAR/G | 2017/2/11 | Human | Hunan |
| EPI\_ISL\_378717 | A/chicken/Guangdong/HZLH1/2017 | PEVPKGKRTAR/G | 2017/2/12 | Chicken | Guangdong |
| EPI\_ISL\_267761 | A/Guangdong/17SF039/2017 | PEVPKRKRTAR/G | 2017/2/15 | Human | Guangdong |
| EPI\_ISL\_273949 | A/Environment/Guangdong/GZ4753/2017 | PEVPKGKRTAR/G | 2017/2/15 | Environment | Guangdong |
| EPI\_ISL\_273951 | A/Environment/Guangzhou/K4756-K4776/2017 | PEVPKGKRTAR/G | 2017/2/15 | Environment | Guangdong |
| EPI\_ISL\_273952 | A/Environment/Guangzhou/K4777-K4882/2017 | PEVPKRKRTAR/G | 2017/2/15 | Environment | Guangdong |
| EPI\_ISL\_258409 | A/Guangxi/1/2017 | PEVPKRKRTAR/G | 2017/2/18 | Human | Guangxi |
| EPI\_ISL\_268499 | A/Guangxi/13452/2017 | PEVPKRKRTAR/G | 2017/2/18 | Human | Guangxi |
| EPI\_ISL\_379653 | A/chicken/Hunan/S1220/2017 | PEVPKRKRTAR/G | 2017/2/20 | Chicken | Hunan |
| EPI\_ISL\_379654 | A/chicken/Hunan/S1221/2017 | PEVPKRKRTAR/G | 2017/2/20 | Chicken | Hunan |
| EPI\_ISL\_379676 | A/duck/Hunan/S1325/2017 | PEVPKRKRTAR/G | 2017/2/20 | Duck | Hunan |
| EPI\_ISL\_267759 | A/Guangdong/17SF033/2017 | PEVPKRKRTAR/G | 2017/2/22 | Human | Guangdong |
| EPI\_ISL\_268512 | A/Guangxi/3/2017 | PEVPKRKRTAR/G | 2017/2/22 | Human | Guangxi |
| EPI\_ISL\_269515 | A/Environment/Guangdong/16609/2017 | PEVPKGKRTAR/G | 2017/2/22 | Environment | Guangdong |
| EPI\_ISL\_268498 | A/Guangxi/13450/2017 | PEVPKRKRTAR/G | 2017/2/23 | Human | Guangxi |
| EPI\_ISL\_285030 | A/Environment/Guangdong/16661/2017 | PEVPKGKRTAR/G | 2017/2/24 | Environment | Guangdong |
| EPI\_ISL\_268501 | A/Guangxi/18891/2017 | PEVPKRKRTAR/G | 2017/2/27 | Human | Guangxi |
| EPI\_ISL\_268502 | A/Guangxi/18892/2017 | PEVPKRKRTAR/G | 2017/2/27 | Human | Guangxi |
| EPI\_ISL\_268524 | A/Guangxi/4/2017 | PEVPKRKRTAR/G | 2017/2/27 | Human | Guangxi |
| EPI\_ISL\_379657 | A/chicken/Hunan/SD083/2017 | PEVPKRKRTAR/G | 2017/2/27 | Chicken | Hunan |
| EPI\_ISL\_268500 | A/Guangxi/18888/2017 | PEVPKRKRTAR/G | 2017/2/28 | Human | Guangxi |
| EPI\_ISL\_268523 | A/Guangxi/5/2017 | PEVPKRKRTAR/G | 2017/2/28 | Human | Guangxi |
| EPI\_ISL\_269513 | A/Hunan/17875/2017 | PEGPKRKRTAR/G | 2017/2/28 | Human | Hunan |
| EPI\_ISL\_327778 | A/Guangdong/GZ8H002/2017 | PEVPKRKRTAR/G | 2017/3/1 | Human | Guangdong |
| EPI\_ISL\_379660 | A/chicken/Guangdong/SD103/2017 | PEVPKGKRTAR/G | 2017/3/2 | Chicken | Guangdong |
| EPI\_ISL\_268503 | A/Guangxi/18895/2017 | PEVPKRKRTAR/G | 2017/3/3 | Human | Guangxi |
| EPI\_ISL\_268504 | A/Guangxi/18897/2017 | PEVPKRKRTAR/G | 2017/3/4 | Human | Guangxi |
| EPI\_ISL\_268526 | A/Guangxi/7/2017 | PEVPKRKRTAR/G | 2017/3/4 | Human | Guangxi |
| EPI\_ISL\_267762 | A/Guangdong/17SF059/2017 | PEVPKRKRTAR/G | 2017/3/6 | Human | Guangdong |
| EPI\_ISL\_269512 | A/Hunan/17874/2017 | PEVPKRKRTAR/G | 2017/3/6 | Human | Hunan |
| EPI\_ISL\_378715 | A/chicken/Guangxi/GX102/2017 | PEVPKRKRTAR/G | 2017/3/6 | Chicken | Guangxi |
| EPI\_ISL\_285033 | A/Environment/Guangxi/24062/2017 | PEVPKRKRTAR/G | 2017/3/9 | Environment | Guangxi |
| EPI\_ISL\_267763 | A/Guangdong/17SF062/2017 | PEVPKRKRTAR/G | 2017/3/11 | Human | Guangdong |
| EPI\_ISL\_379661 | A/chicken/Hunan/SD107/2017 | PEVPKRKRTAR/G | 2017/3/11 | Chicken | Hunan |
| EPI\_ISL\_379662 | A/chicken/Hunan/SD108/2017 | PEVPKRKRTAR/G | 2017/3/11 | Chicken | Hunan |
| EPI\_ISL\_259757 | A/Shenzhen/Th0007/2017 | PEVPKRKRTAR/G | 2017/3/12 | Human | Guangdong |
| EPI\_ISL\_267764 | A/Guangdong/17SF064/2017 | PEVPKRKRTAR/G | 2017/3/12 | Human | Guangdong |
| EPI\_ISL\_268505 | A/Guangxi/18902/2017 | PEVPKRKRTAR/G | 2017/3/12 | Human | Guangxi |
| EPI\_ISL\_259759 | A/environment/Guangdong/03.13\_SZBA-E1/2017 | PEVPKGKRTAR/G | 2017/3/13 | Environment | Guangdong |
| EPI\_ISL\_268506 | A/Guangxi/18906/2017 | PEVPKRKRTAR/G | 2017/3/14 | Human | Guangxi |
| EPI\_ISL\_285034 | A/Environment/Guangxi/24092/2017 | PEVPKRKRTAR/G | 2017/3/14 | Environment | Guangxi |
| EPI\_ISL\_285035 | A/Environment/Guangxi/24097/2017 | PEVPKRKRTAR/G | 2017/3/14 | Environment | Guangxi |
| EPI\_ISL\_268507 | A/Guangxi/18908/2017 | PEVPKRKRTAR/G | 2017/3/16 | Human | Guangxi |
| EPI\_ISL\_268508 | A/Guangxi/18910/2017 | PEVPKRKRTAR/G | 2017/3/18 | Human | Guangxi |
| EPI\_ISL\_268509 | A/Guangxi/18911/2017 | PEVPKRKRTAR/G | 2017/3/18 | Human | Guangxi |
| EPI\_ISL\_379663 | A/chicken/Hunan/SD130/2017 | PEVPKRKRTAR/G | 2017/3/21 | Chicken | Hunan |
| EPI\_ISL\_379665 | A/chicken/Fujian/SD136/2017 | PEVPKGKRTAR/G | 2017/3/26 | Chicken | Fujian |
| EPI\_ISL\_297774 | A/GD-ZS029/H7N9/2017-03-28 | PEVPKRRRTAR/G | 2017/3/28 | Human | Guangdong |
| EPI\_ISL\_378713 | A/chicken/Guangxi/GX110/2017 | PEVPKRKRTAR/G | 2017/3/28 | Chicken | Guangxi |
| EPI\_ISL\_329150 | A/chicken/Guangdong/30/2017 | PEVPKRKRTAR/G | 2017/3/30 | Chicken | Guangdong |
| EPI\_ISL\_269510 | A/Environment/Beijing/22166/2017 | PEVPKRKRTAR/G | 2017/4/6 | Environment | Beijing |
| EPI\_ISL\_285032 | A/Environment/Guangxi/23659/2017 | PEVPKRKRTAR/G | 2017/4/7 | Environment | Guangxi |
| EPI\_ISL\_696534 | A/goose/Guangdong/Q70/2017 | PEVPKRKRTAR/G | 2017/4/9 | Goose | Guangdong |
| EPI\_ISL\_269517 | A/Hunan/25351/2017 | PEVPKRKRTAR/G | 2017/4/11 | Human | Hunan |
| EPI\_ISL\_273950 | A/Dressed\_chicken/Guangdong/GZ631/2017 | PEVPKRKRTAR/G | 2017/4/13 | Chicken | Guangdong |
| EPI\_ISL\_379658 | A/chicken/Guangxi/SD097/2017 | PEVPKGKRTAR/G | 2017/4/18 | Chicken | Guangxi |
| EPI\_ISL\_379659 | A/chicken/Guangxi/SD098/2017 | PEVPKRKRTAR/G | 2017/4/18 | Chicken | Guangxi |
| EPI\_ISL\_379664 | A/chicken/Guangxi/SD131/2017 | PEVPKGKRTAR/G | 2017/4/18 | Chicken | Guangxi |
| EPI\_ISL\_379677 | A/duck/Guangxi/S21445/2017 | PEVPKRKRTAR/G | 2017/4/18 | Duck | Guangxi |
| EPI\_ISL\_274206 | A/chicken/Heinan/ZZ01/2017 | PEVPKRKRTAR/G | 2017/4/24 | Chicken | Henan |
| EPI\_ISL\_269514 | A/Environment/Hebei/25346/2017 | PEVPKRKRTAR/G | 2017/4/26 | Environment | Hebei |
| EPI\_ISL\_266935 | A/Shenzhen/Th008/2017(H7N9) | PEVPKRKRTAR/G | 2017/4/27 | Human | Guangdong |
| EPI\_ISL\_266936 | A/Shenzhen/Th008/2017(H7N9) | PEVPKRKRTAR/G | 2017/4/27 | Human | Guangdong |
| EPI\_ISL\_295066 | A/duck/Guangdong/4.30\_DGCPLB029-P/2017 | PEVPKRKRTAR/G | 2017/4/30 | Duck | Guangdong |
| EPI\_ISL\_295067 | A/duck/Guangdong/4.30\_DGCPLB014-O/2017 | PEVPKRKRTAR/G | 2017/4/30 | Duck | Guangdong |
| EPI\_ISL\_379667 | A/chicken/Hebei/SD156/2017 | PEVPKRKRTAR/G | 2017/5/1 | Chicken | Hebei |
| EPI\_ISL\_436706 | A/chick/Guangxi/YL01/2017 | PEVPKRKRTAR/G | 2017/5/1 | Chicken | Guangxi |
| EPI\_ISL\_436711 | A/chicken/Henan/zk01/2017 | PEVPKRKRTAR/G | 2017/5/1 | Chicken | Henan |
| EPI\_ISL\_266937 | A/chicken/Shandong/05.05\_DZ056/2017(H7N9)\_ | PEVPKRKRTAR/G | 2017/5/5 | Chicken | Shandong |
| EPI\_ISL\_269518 | A/Shaanxi/29412/2017 | PEVPKRKRTAR/G | 2017/5/5 | Human | Shaanxi |
| EPI\_ISL\_269520 | A/Environment/Shaanxi/29414/2017 | PEVPKRKRTAR/G | 2017/5/5 | Environment | Shaanxi |
| EPI\_ISL\_269521 | A/Environment/Shaanxi/29415/2017 | PEVPKRKRTAR/G | 2017/5/5 | Environment | Shaanxi |
| EPI\_ISL\_276783 | A/chicken/Shandong/05.05\_DZ056/2017 | PEVPKRKRTAR/G | 2017/5/5 | Chicken | Shandong |
| EPI\_ISL\_378714 | A/chicken/Henan/HNXY1/2017 | PEVPKRKRTAR/G | 2017/5/5 | Chicken | Henan |
| EPI\_ISL\_379666 | A/chicken/Henan/SD142/2017 | PEVPKRKRTAR/G | 2017/5/7 | Chicken | Henan |
| EPI\_ISL\_379668 | A/chicken/Henan/SD163/2017 | PEVPKRKRTAR/G | 2017/5/7 | Chicken | Henan |
| EPI\_ISL\_269516 | A/Hebei/27407/2017 | PEVPKRKRTAR/G | 2017/5/13 | Human | Hebei |
| EPI\_ISL\_378716 | A/chicken/Hebei/SJ27/2017 | PEVPKRKRTAR/G | 2017/5/14 | Chicken | Hebei |
| EPI\_ISL\_379669 | A/chicken/Tianjing/SD182/2017 | PEVPKRKRTAR/G | 2017/5/20 | Chicken | Tianjin |
| EPI\_ISL\_297773 | A/Env/GD-MZ073/H7N9/2017-05-23 | PEVPKGKRTAR/G | 2017/5/23 | Environment | Guangdong |
| EPI\_ISL\_292347 | A/Ordos\_Inner\_Mongolia/0526/2017 | PEVPKRKRTAR/G | 2017/5/26 | Human | Inner\_Mongolia |
| EPI\_ISL\_379670 | A/chicken/Shaanxi/SD183/2017 | PEVPKRKRTAR/G | 2017/5/27 | Chicken | Shaanxi |
| EPI\_ISL\_269519 | A/Environment/Shaanxi/29413/2017 | PEVPKRKRTAR/G | 2017/5/30 | Environment | Shaanxi |
| EPI\_ISL\_327800 | A/chicken/Heilongjiang/BQC01/2017 | PEVPKRKRTAR/G | 2017/6/1 | Chicken | Heilongjiang |
| EPI\_ISL\_378726 | A/duck/Southern\_China/01/2017 | PEVPKRKRTAR/G | 2017/6/1 | Duck | Southern\_China |
| EPI\_ISL\_269522 | A/Environment/Inner\_Mongolia/28651/2017 | PEVPKRKRTAR/G | 2017/6/2 | Environment | Inner\_Mongolia |
| EPI\_ISL\_379671 | A/chicken/Inner\_Mongolia/SD186/2017 | PEVPKRKRTAR/G | 2017/6/5 | Chicken | Inner\_Mongolia |
| EPI\_ISL\_276785 | A/chicken/Fujian/06.06\_NP0001/2017 | PEVPKRKRTAR/G | 2017/6/6 | Chicken | Fujian |
| EPI\_ISL\_285262 | A/Shaanxi/32287/2017 | PEVPKRKRTAR/G | 2017/6/6 | Human | Shaanxi |
| EPI\_ISL\_379672 | A/chicken/Inner\_Mongolia/SD188/2017 | PEVPKRKRTAR/G | 2017/6/6 | Chicken | Inner\_Mongolia |
| EPI\_ISL\_379673 | A/chicken/Heilongjiang/SD190/2017 | PEVPKRKRTAR/G | 2017/6/13 | Chicken | Heilongjiang |
| EPI\_ISL\_266963 | A/Guangdong/17SF003/2016 | PEVPKRKRTAR/G | 2017/6/19 | Human | Guangdong |
| EPI\_ISL\_697599 | A/China/Influenza\_A\_virus/2017 | PEVPKRKRTAR/G | 2017/6/30 | Human | China |
| EPI\_ISL\_378724 | A/duck/Southern\_China/04/2017 | PEVPKRKRTAR/G | 2017/7/5 | Human | Southern\_China |
| EPI\_ISL\_314056 | A/Fujian/33845/2017 | PEVPKRKRTAR/G | 2017/8/1 | Human | Fujian |
| EPI\_ISL\_389796 | A/chicken/Guangxi/97/2017 | PEVPKRKRTAR/G | 2017/8/5 | Chicken | Guangxi |
| EPI\_ISL\_314055 | A/Environment/Fujian/36998/2017 | PEVPKRKRTAR/G | 2017/8/14 | Environment | Fujian |
| EPI\_ISL\_379674 | A/chicken/Anhui/SD206/2017 | PEVPKRKRTAR/G | 2017/8/21 | Chicken | Anhui |
| EPI\_ISL\_297772 | A/Env/GD-YJ370/H7N9/2017-09-14 | PEVPKRKRTAR/G | 2017/9/14 | Environment | Guangdong |
| EPI\_ISL\_379679 | A/duck/Fujian/SD208/2017 | PEVPKRKRTAR/G | 2017/9/18 | Duck | Fujian |
| EPI\_ISL\_314054 | A/Environment/Fujian/40791/2017 | PEVPKRKRAAR/G | 2017/10/18 | Environment | Fujian |
| EPI\_ISL\_314052 | A/Environment/Fujian/40844/2017 | PEVPKRKRTAR/G | 2017/10/24 | Environment | Fujian |
| EPI\_ISL\_314053 | A/Environment/Fujian/40843/2017 | PEVPKRKRTAR/G | 2017/10/24 | Environment | Fujian |
| EPI\_ISL\_379656 | A/chicken/Tibet/S3268/2017 | PEVPKRKRTAR/G | 2017/11/2 | Chicken | Tibet |
| EPI\_ISL\_379675 | A/chicken/Yunnan/SD210/2017 | PEVPKRKRTAR/G | 2017/11/21 | Chicken | Yunnan |
| EPI\_ISL\_314051 | A/Environment/Fujian/43639/2017 | PEVPKRKRTAR/G | 2017/12/5 | Environment | Fujian |
| EPI\_ISL\_379678 | A/duck/Fujian/SD001/2018 | PEVPKRKRTAR/G | 2018/1/5 | Duck | Fujian |
| EPI\_ISL\_315152 | A/Enviroment/Xuzhou/4030/2018 | PEVPKRKRTAR/G | 2018/1/29 | Environment | Jiangsu |
| EPI\_ISL\_1374052 | A/chicken/Anhui/SE0105/2018 | PEVPKRKRTAR/G | 2018/2/1 | Chicken | Anhui |
| EPI\_ISL\_1374053 | A/chicken/Anhui/SE0296/2018 | PEVPKRKRTAR/G | 2018/2/1 | Chicken | Anhui |
| EPI\_ISL\_1374054 | A/duck/Fujian/SE0377/2018 | PEVPKRKRTAR/G | 2018/2/1 | Duck | Fujian |
| EPI\_ISL\_1374055 | A/chicken/Liaoning/SD003/2018 | PEVPKRKRTAR/G | 2018/2/1 | Chicken | Liaoning |
| EPI\_ISL\_327406 | A/chicken/Shaanxi/F223/2018 | PEVPKRKRTAR/G | 2018/2/26 | Chicken | Shaanxi |
| EPI\_ISL\_1374056 | A/chicken/Shaanxi/SD004/2018 | PEVPKRKRTAR/G | 2018/3/1 | Chicken | Shaanxi |
| EPI\_ISL\_1374057 | A/chicken/Anhui/S1032/2018 | PEVPKRKRTAR/G | 2018/3/1 | Chicken | Anhui |
| EPI\_ISL\_1374058 | A/chicken/Shanxi/SD006/2018 | PEVPKRKRTAR/G | 2018/4/1 | Chicken | Shanxi |
| EPI\_ISL\_1374059 | A/chicken/Ningxia/SD007/2018 | PEVPKRKRTAR/G | 2018/4/1 | Chicken | Ningxia |
| EPI\_ISL\_327408 | A/duck/Guangdong/F450/2018 | PEVPKRKRTAR/G | 2018/4/11 | Duck | Guangdong |
| EPI\_ISL\_372783 | A/China/LN/2018 | PEVPKRKRTAR/G | 2018/4/26 | Human | China |
| EPI\_ISL\_1374060 | A/chicken/Ningxia/SD008/2018 | PEVPKRKRTAR/G | 2018/5/1 | Chicken | Ningxia |
| EPI\_ISL\_1374061 | A/chicken/Liaoning/SD009/2018 | PEVPKRKRTAR/G | 2018/5/1 | Chicken | Liaoning |
| EPI\_ISL\_314817 | A/Environment/Changzhou/022/2018 | PEVPKRKRTAR/G | 2018/5/3 | Environment | Guangdong |
| EPI\_ISL\_502881 | A/quail/Hebei/0607/2018 | PEVPKRKRTAR/G | 2018/6/7 | Quail | Hebei |
| EPI\_ISL\_482747 | A/chicken/Northern\_China/SD3866/2018(H7N9) | PEVPKRKRTAR/G | 2018/7/10 | Chicken | Northern\_China |
| EPI\_ISL\_482756 | A/chicken/Northern\_China/SX4748/2018(H7N9) | PEVPKRKRTAR/G | 2018/8/21 | Chicken | Northern\_China |
| EPI\_ISL\_1374062 | A/chicken/Hebei/SD010/2018 | PEVPKRKRTAR/G | 2018/10/1 | Chicken | Hebei |
| EPI\_ISL\_1374063 | A/chicken/Liaoning/SD014/2018 | PEVPKRKRTAR/G | 2018/11/1 | Chicken | Liaoning |
| EPI\_ISL\_503141 | A/chicken/China/FQ2/2019 | PEVPKRKRTAR/G | 2019/2/17 | Chicken | China |
| EPI\_ISL\_408432 | A/Chicken/East\_China/H7SD12/2019(H7N9) | PEVPKRKRTAR/G | 2019/3/1 | Chicken | East\_China |
| EPI\_ISL\_408433 | A/Chicken/East\_China/H7SD13/2019(H7N9) | PEVPKRKRTAR/G | 2019/3/1 | Chicken | East\_China |
| EPI\_ISL\_408434 | A/Chicken/East\_China/H7SD26/2019(H7N9) | PEVPKRKRTAR/G | 2019/3/1 | Chicken | East\_China |
| EPI\_ISL\_408435 | A/Chicken/Northeast\_China/LN19010/2019(H7N9) | PEVPKRKRTAR/G | 2019/3/1 | Chicken | Northeast\_China |
| EPI\_ISL\_1374064 | A/peacock/Liaoning/SD004/2019 | PEVPKRKRTAR/G | 2019/3/1 | Peacock | Liaoning |
| EPI\_ISL\_353991 | A/Gansu/23277/2019 | PEVPKRKRTAR/G | 2019/4/1 | Human | Gansu |
| EPI\_ISL\_353997 | A/Gansu/23277/2019 | PEVPKRKRTAR/G | 2019/4/1 | Human | Gansu |
| EPI\_ISL\_408436 | A/Chicken/Northeast\_China/LN-L/2019(H7N9) | PEVPKRKRTAR/G | 2019/4/1 | Chicken | Northeast\_China |
| EPI\_ISL\_408437 | A/Chicken/Northeast\_China/LN190401/2019(H7N9) | PEVPKRKRTAR/G | 2019/4/1 | Chicken | Northeast\_China |
| EPI\_ISL\_408445 | A/Chicken/Northeast\_China/19376-E5/2019(H7N9) | PEVPKGKRTAR/G | 2019/4/1 | Chicken | Northeast\_China |
| EPI\_ISL\_1374065 | A/chicken/Inner\_Mongolia/SD010/2019 | PEVPKRKRTAR/G | 2019/4/1 | Chicken | Inner\_Mongolia |
| EPI\_ISL\_1374066 | A/chicken/Hebei/S1118/2019 | PEVPKRKRTAR/G | 2019/4/1 | Chicken | Hebei |
| EPI\_ISL\_1374067 | A/chicken/Hebei/S1140/2019 | PEVPKRKRTAR/G | 2019/4/1 | Chicken | Hebei |
| EPI\_ISL\_1374068 | A/chicken/Hebei/S1177/2019 | PEVPKRKRTAR/G | 2019/4/1 | Chicken | Hebei |
| EPI\_ISL\_353992 | A/Gansu/23276/2019 | PEVPKRKRTAR/G | 2019/4/3 | Human | Gansu |
| EPI\_ISL\_353993 | A/Gansu/23275/2019 | PEVPKRKRTAR/G | 2019/4/3 | Human | Gansu |
| EPI\_ISL\_353998 | A/Gansu/23276/2019 | PEVPKRKRTAR/G | 2019/4/3 | Human | Gansu |
| EPI\_ISL\_353999 | A/Gansu/23275/2019 | PEVPKRKRTAR/G | 2019/4/3 | Human | Gansu |
| EPI\_ISL\_353990 | A/Gansu/23447/2019 | PEVPKRKRTAR/G | 2019/4/4 | Human | Gansu |
| EPI\_ISL\_353994 | A/Gansu/23453/2019 | PEVPKRKRTAR/G | 2019/4/4 | Human | Gansu |
| EPI\_ISL\_353984 | A/Environment/Inner\_Mongolia/23287/2019 | PEVPKRKRTAR/G | 2019/4/5 | Environment | Inner\_Mongolia |
| EPI\_ISL\_353985 | A/Environment/Inner\_Mongolia/23286/2019 | PEVPKRKRTAR/G | 2019/4/5 | Environment | Inner\_Mongolia |
| EPI\_ISL\_353986 | A/Environment/Inner\_Mongolia/23285/2019 | PEVPKRKRTAR/G | 2019/4/5 | Environment | Inner\_Mongolia |
| EPI\_ISL\_353987 | A/Environment/Inner\_Mongolia/23283/2019 | PEVPKRKRTAR/G | 2019/4/5 | Environment | Inner\_Mongolia |
| EPI\_ISL\_353988 | A/Environment/Inner\_Mongolia/23280/2019 | PEVPKRKRTAR/G | 2019/4/5 | Environment | Inner\_Mongolia |
| EPI\_ISL\_353989 | A/Environment/Inner\_Mongolia/23278/2019 | PEVPKRKRTAR/G | 2019/4/5 | Environment | Inner\_Mongolia |
| EPI\_ISL\_353995 | A/Environment/Inner\_Mongolia/23280/2019 | PEVPKRKRTAR/G | 2019/4/5 | Environment | Inner\_Mongolia |
| EPI\_ISL\_353996 | A/Environment/Inner\_Mongolia/23286/2019 | PEVPKRKRTAR/G | 2019/4/5 | Environment | Inner\_Mongolia |
| EPI\_ISL\_408438 | A/Chicken/Northeast\_China/LN190405-4/2019(H7N9) | PEVPKRKRTAR/G | 2019/4/5 | Chicken | Northeast\_China |
| EPI\_ISL\_408439 | A/Chicken/Northeast\_China/LN190408A/2019(H7N9) | PEVPKRKRTAR/G | 2019/4/8 | Chicken | Northeast\_China |
| EPI\_ISL\_408440 | A/Chicken/Northeast\_China/LN190410/2019(H7N9) | PEVPKRKRIAR/G | 2019/4/10 | Chicken | Northeast\_China |
| EPI\_ISL\_408420 | A/Chicken/Northeast\_China/19155/2019(H7N9) | PEVPKRKRIAR/G | 2019/4/12 | Chicken | Northeast\_China |
| EPI\_ISL\_408441 | A/Chicken/Northeast\_China/LN190413/2019(H7N9) | PEVPKRKRTAR/G | 2019/4/13 | Chicken | Northeast\_China |
| EPI\_ISL\_408421 | A/Chicken/Northeast\_China/19201/2019(H7N9) | PEVPKRKRTAR/G | 2019/4/25 | Chicken | Northeast\_China |
| EPI\_ISL\_408422 | A/Chicken/Northeast\_China/19203-2/2019(H7N9) | PEVPKRKRTAR/G | 2019/4/26 | Chicken | Northeast\_China |
| EPI\_ISL\_503142 | A/chicken/China/QHD1/2019 | PEVPKRKRTAR/G | 2019/4/27 | Chicken | China |
| EPI\_ISL\_408442 | A/Chicken/Northeast\_China/LN190528/2019(H7N9) | PEVPKRKRTAR/G | 2019/4/28 | Chicken | Northeast\_China |
| EPI\_ISL\_408423 | A/Chicken/Northeast\_China/19225/2019(H7N9) | PEVPKRKRTAR/G | 2019/5/6 | Chicken | Northeast\_China |
| EPI\_ISL\_408424 | A/Chicken/Northeast\_China/19254/2019(H7N9) | PEVPKRKRTAR/G | 2019/5/15 | Chicken | Northeast\_China |
| EPI\_ISL\_503146 | A/chicken/China/HD1/2019 | PEVPKRKRTAR/G | 2019/5/25 | Chicken | China |
| EPI\_ISL\_408425 | A/Chicken/Northeast\_China/19291/2019(H7N9) | PEVPKRKRTAR/G | 2019/5/27 | Chicken | Northeast\_China |
| EPI\_ISL\_408426 | A/Chicken/Northeast\_China/19300-2/2019(H7N9) | PEVPKRKRTAR/G | 2019/6/3 | Chicken | Northeast\_China |
| EPI\_ISL\_503143 | A/chicken/China/DL614/2019 | PEVPKRKRTAR/G | 2019/6/14 | Chicken | China |
| EPI\_ISL\_503147 | A/chicken/China/DL1/2019 | PEVPKRKRTAR/G | 2019/6/18 | Chicken | China |
| EPI\_ISL\_408446 | A/Chicken/North\_China/HeB1907/2019(H7N9) | PEVPKRKRTAR/G | 2019/7/1 | Chicken | Northeast\_China |
| EPI\_ISL\_408447 | A/Chicken/Northeast\_China/LN/2019(H7N9) | PEVPKRKRTAR/G | 2019/7/1 | Chicken | Northeast\_China |
| EPI\_ISL\_503144 | A/chicken/China/AS1/2019 | PEVPKRKRTAR/G | 2019/7/1 | Chicken | China |
| EPI\_ISL\_408443 | A/Chicken/Northeast\_China/LN190705A/2019(H7N9) | PEVPKRKRTAR/G | 2019/7/5 | Chicken | Northeast\_China |
| EPI\_ISL\_503145 | A/chicken/China/WYG1/2019 | PEVPKRKRTAR/G | 2019/7/12 | Chicken | China |
| EPI\_ISL\_408444 | A/Chicken/Northeast\_China/LN190716/2019(H7N9) | PEVPKRKRTAR/G | 2019/7/16 | Chicken | Northeast\_China |
| EPI\_ISL\_408448 | A/Chicken/North\_China/HeB1908/2019(H7N9) | PEVPKRKRTAR/G | 2019/8/1 | Chicken | Northeast\_China |
| EPI\_ISL\_408419 | A/Chicken/Northeast\_China/19743/2019(H7N9) | PEVPKRKRTAR/G | 2019/10/12 | Chicken | Northeast\_China |
| EPI\_ISL\_408427 | A/Chicken/Northeast\_China/19797/2019(H7N9) | PEVPKRKRTAR/G | 2019/10/31 | Chicken | Northeast\_China |
| EPI\_ISL\_1374069 | A/chicken/Liaoning/SD025/2019 | PEVPKRKRTAR/G | 2019/11/1 | Chicken | Liaoning |
| EPI\_ISL\_408428 | A/Chicken/Northeast\_China/19854-2/2019(H7N9) | PEVPKRKRTAR/G | 2019/11/13 | Chicken | Northeast\_China |
| EPI\_ISL\_408429 | A/Chicken/Northeast\_China/19854-6/2019(H7N9) | PEVPKRKRTAR/G | 2019/11/13 | Chicken | Northeast\_China |
| EPI\_ISL\_1374070 | A/chicken/Liaoning/SD026/2019 | PEVPKRKRTAR/G | 2019/12/1 | Chicken | Liaoning |

**Supplementary Table S2** Geographic distribution of HP-H7N9 viruses in China containing different cleavage site motifs.

|  |  |  |  |
| --- | --- | --- | --- |
| **Province** | **Cleavage site motif** |  | **n (%)** |
| Guangdong  (n = 83) | PEVPKRKRTAR/G |  | 38 (45.8) |
| PEVPKGKRTAR/G |  | 42 (50.6) |
| PEVPKRKRAAR/G |  | 1 (1.2) |
| PEVPKRRRTAR/G |  | 2 (2.4) |
| Guangxi  (n = 29) | PEVPKRKRTAR/G |  | 27 (93.1) |
| PEVPKGKRTAR/G |  | 2 (6.9) |
| Beijing  (n = 1) | PEVPKRKRTAR/G |  | 1 (100) |
| Hunan  (n = 11) | PEVPKRKRTAR/G |  | 8 (72.7) |
| PEVPKGKRTAR/G |  | 3 (27.3) |
| Hebei  (n = 12) | PEVPKRKRTAR/G |  | 12 (100) |
| Shaanxi  (n = 8) | PEVPKRKRTAR/G |  | 8 (100) |
| Inner Mongolia  (n = 15) | PEVPKRKRTAR/G |  | 15 (100) |
| Shandong  (n = 3) | PEVPKRKRTAR/G |  | 3 (100) |
| Fujian  (n = 11) | PEVPKRKRTAR/G |  | 10 (90.9) |
| PEVPKGKRTAR/G |  | 1 (9.1) |
| Jiangsu  (n = 2) | PEVPKRKRTAR/G |  | 2 (100) |
| Heilongjiang  (n = 2) | PEVPKRKRTAR/G |  | 2 (100) |
| Gansu  (n = 8) | PEVPKRKRTAR/G |  | 8 (100) |
| Henan  (n = 4) | PEVPKRKRTAR/G |  | 4 (100) |
| Tibet  (n = 1) | PEVPKRKRTAR/G |  | 1 (100) |
| Anhui  (n = 4) | PEVPKRKRTAR/G |  | 4 (100) |
| Liaoning  (n = 24) | PEVPKRKRTAR/G |  | 22 (91.6) |
| PEVPKGKRTAR/G |  | 1 (4.2) |
| PEVPKRKRIAR/G |  | 1 (4.2) |
| Shanxi  (n = 1) | PEVPKRKRTAR/G |  | 1 (100) |
| Ningxia  (n = 2) | PEVPKRKRTAR/G |  | 2 (100) |
| Tianjin  (n = 1) | PEVPKRKRTAR/G |  | 1 (100) |
| Yunnan  (n = 1) | PEVPKRKRTAR/G |  | 1 (100) |

*HP*, Highly pathogenic.

**Supplementary Table S3** Frequency of amino acid residue at 335 site in the HA protein of H7N9 viruses.

|  |  |  |
| --- | --- | --- |
| **Subtype** | **Amino acid residue** | **n (%)** |
| LP-H7N9  (n = 2490) | I | 2479 (99.6) |
| L | 4 (0.16) |
| T | 3 (0.12) |
| V | 4 (0.16) |
| HP-H7N9  (n = 242) | I  G | 1 (0.4)  1 (0.4) |
| V | 222 (99.2) |

*LP*, low pathogenic; *HP*, highly pathogenic; *HA*, Hemagglutinin.