**Table S1:** The information of 18 IBV reference

| Strain   | Country          | Genotype | Year of isolation | Accession number |
|----------|------------------|----------|-------------------|------------------|
| H120     | Vaccine Strain   | Mass     | Vaccine Strain    | EU822341         |
| H52      | Vaccine Strain   | Mass     | Vaccine Strain    | AF352315         |
| M41      | Vaccine Strain   | Mass     | Vaccine Strain    | DQ834384         |
| Beaudette| Vaccine Strain   | Mass     | Vaccine Strain    | M95169           |
| Ma5      | Vaccine Strain   | Mass     | Vaccine Strain    | M95169           |
| LX4      | Xinjiang, China  | LX4      | 1999              | AY338732         |
| QXIBV    | Shandong, China  | LX4      | 1997              | AF193423         |
| ZY3      | Sichuan, China   | LX4      | 2009              | JF732903         |
| WF       | Shandong, China  | LX4      | 2016              | DQ480151         |
| CK/CH/JS/TC1411-4 | Guangdong, China | LX4  | 2016              | KX107820         |
| 4/91     | Vaccine Strain   | 4/91     | 1992              | AF093794         |
| A2       | Beijing, China   | 99I      | 1996              | EU526388         |
| SAIBK    | Sichuan, China   | 99I      | Unknown           | DQ288927         |
| CQ04-1   | Chongqing, China | 99I      | 2004              | GQ265952         |
| 2296/95  | Taiwan, China    | TW-II    | 1995              | AY606321         |
| 2575/98  | Taiwan, China    | TW-1     | 1998              | AY606314         |
| TC07-2   | Guangdong, China | TC07-2   | 2016              | GQ265948         |
| CK/CH/GD/KP10 | Guangdong, China | TC07-2 | 2012              | HQ018919         |

**Table S2:** The challenge schedule of 5 QX-genotype IBVs

| Group | Challenge (10^5 EID_{50}) | Survival study and lesions observation (12-18 days old) | RT-qPCR assay (14, 16, 18 days old) |
|-------|---------------------------|--------------------------------------------------------|-------------------------------------|
| A     | CK/CH/SC/MS/17            | 10 days old                                           | 12                                  |
| B     | CK/CH/SC/PZ/17            | 10 days old                                           | 12                                  |
| C     | CK/CH/SC/DYYJ/17          | 10 days old                                           | 12                                  |
| D     | CK/CH/SC/GH/15            | 10 days old                                           | 12                                  |
| E     | CK/CH/SC/DYW/16           | 10 days old                                           | 12                                  |
| F     | Sterilized PBS            | 10 days old                                           | 6                                   |
