Phylogenetics and Pathogenesis of Early Avian Influenza Viruses (H5N1), Nigeria

Technical Appendix

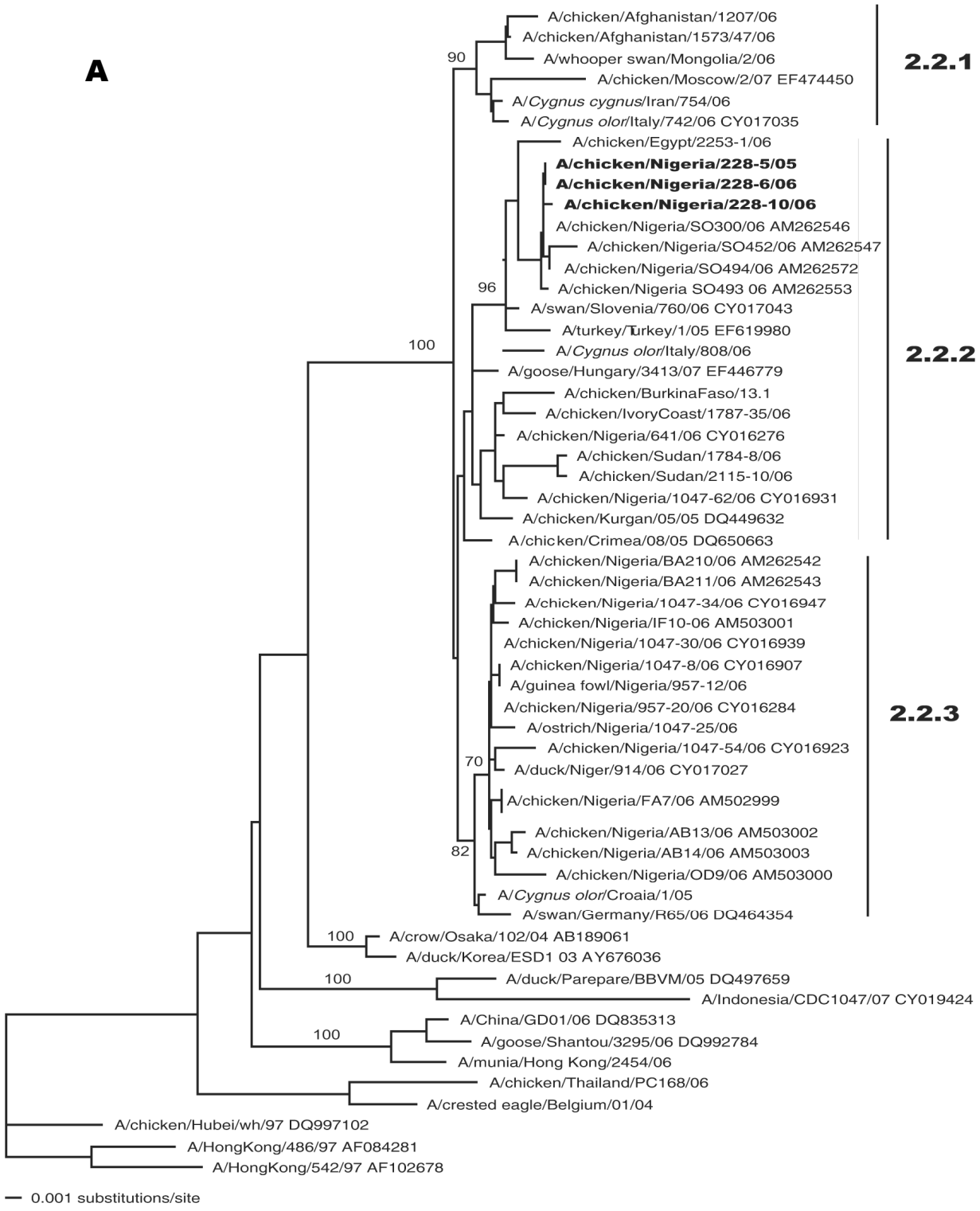
Neighbor-joining phylogenetic trees shown on the following pages were generated based on the A) hemagglutinin, B) neuraminidase, C) nucleocapsid protein, and D) nonstructural sequences of influenza viruses (H5N1). Influenza (H5N1) clades (2.2.1, 2.2.2 or 2.2.3) are indicated on trees. Viruses sequenced in this study are shown in **boldface**. Numbers indicate bootstrap values. Complete nucleotide sequences were aligned by using the Clustal program (*1*), and phylogenetic analyses were performed by using the PAUP program, version 4.0 beta 10 (*2*), with the neighbor-joining method using the HKY85 distance formula. Bootstrap analyses were conducted with 1,000 to place confidence values on groupings within trees (*3*).

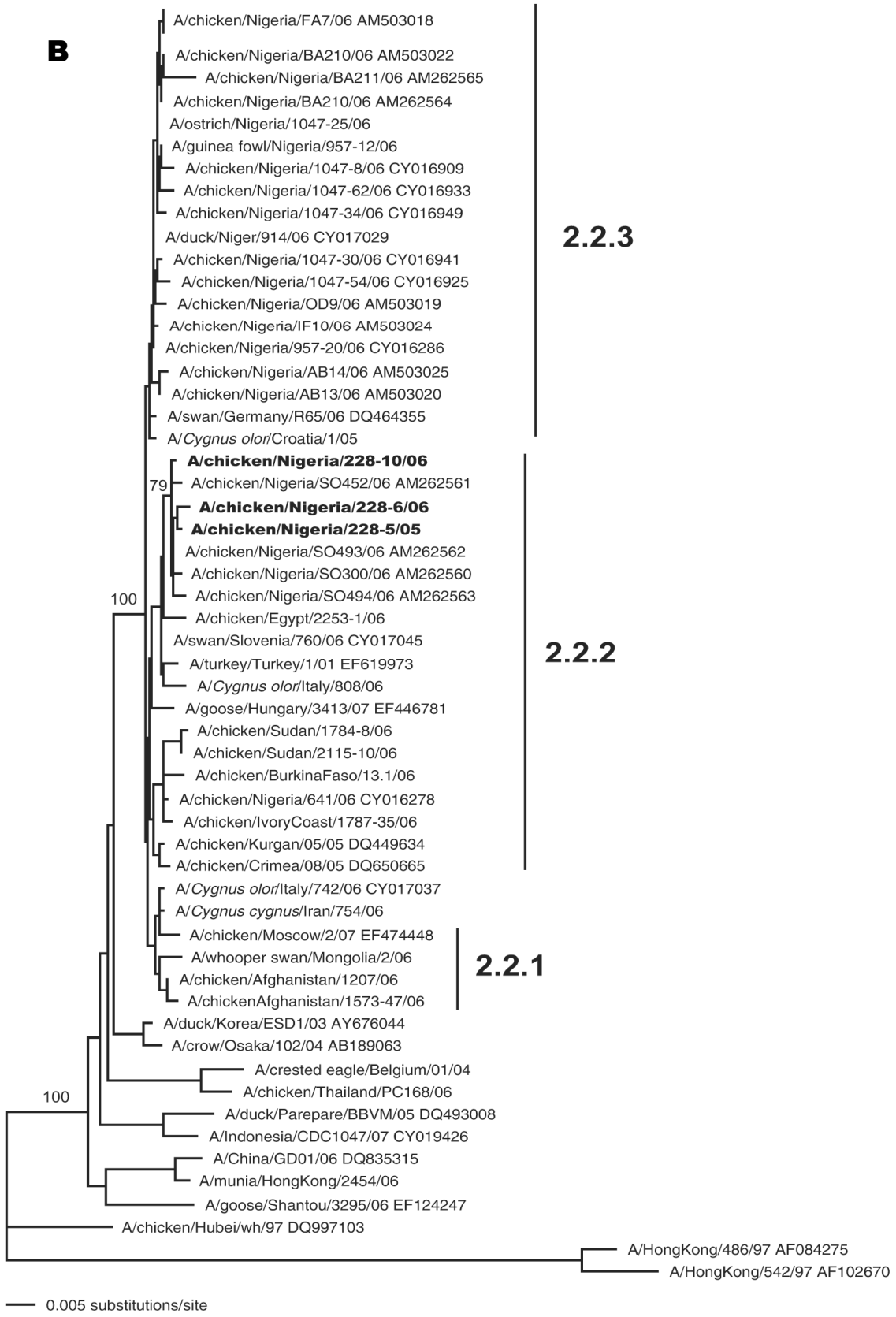
References

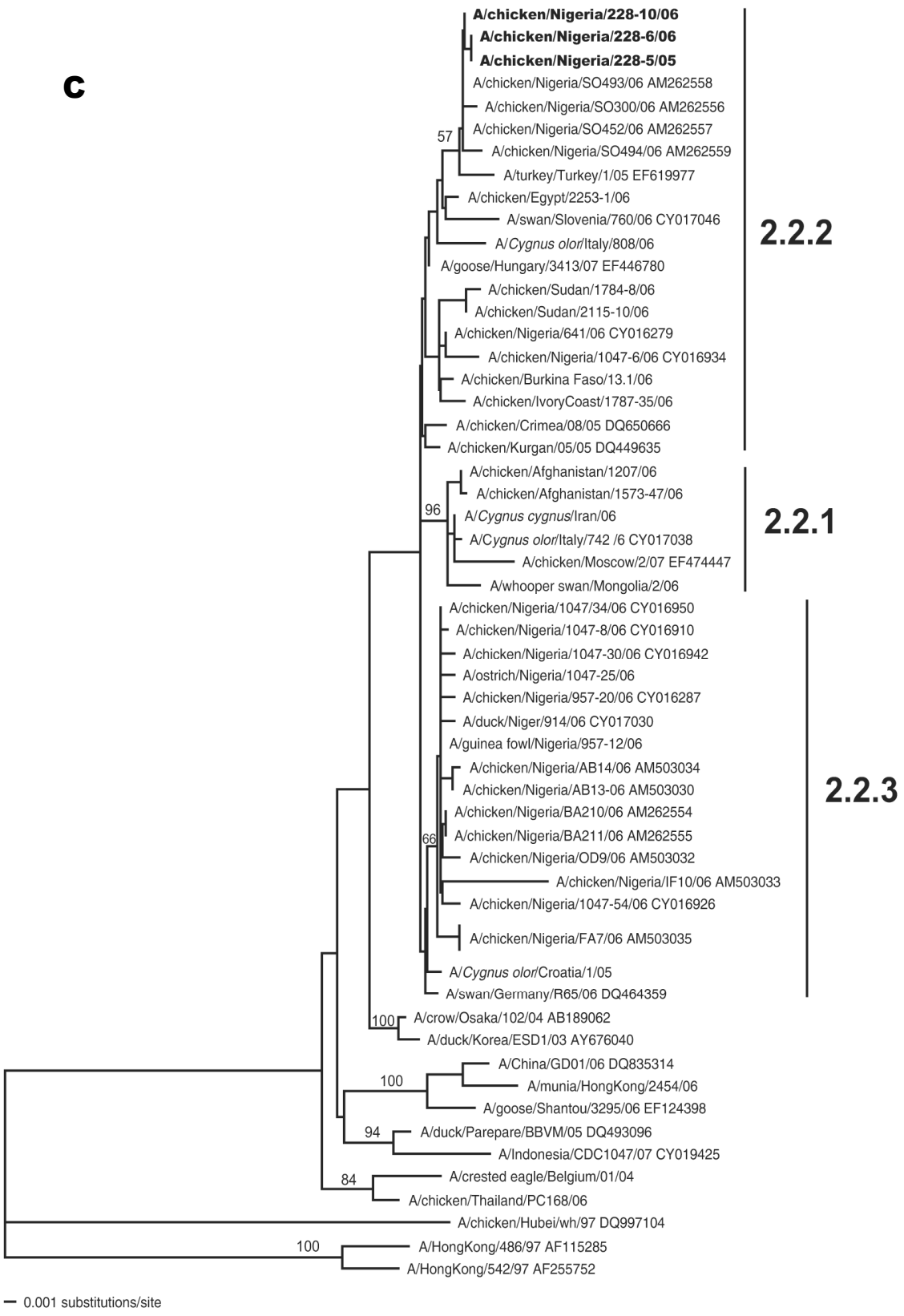
1. Larkin MA, Blackshields G, Brown NP, Chenna R, McGettigan PA, McWilliam H, et al. ClustalW and ClustalX version 2. Bioinformatics. 2007;23:2947–8. PubMed DOI: 10.1093/bioinformatics/btm404

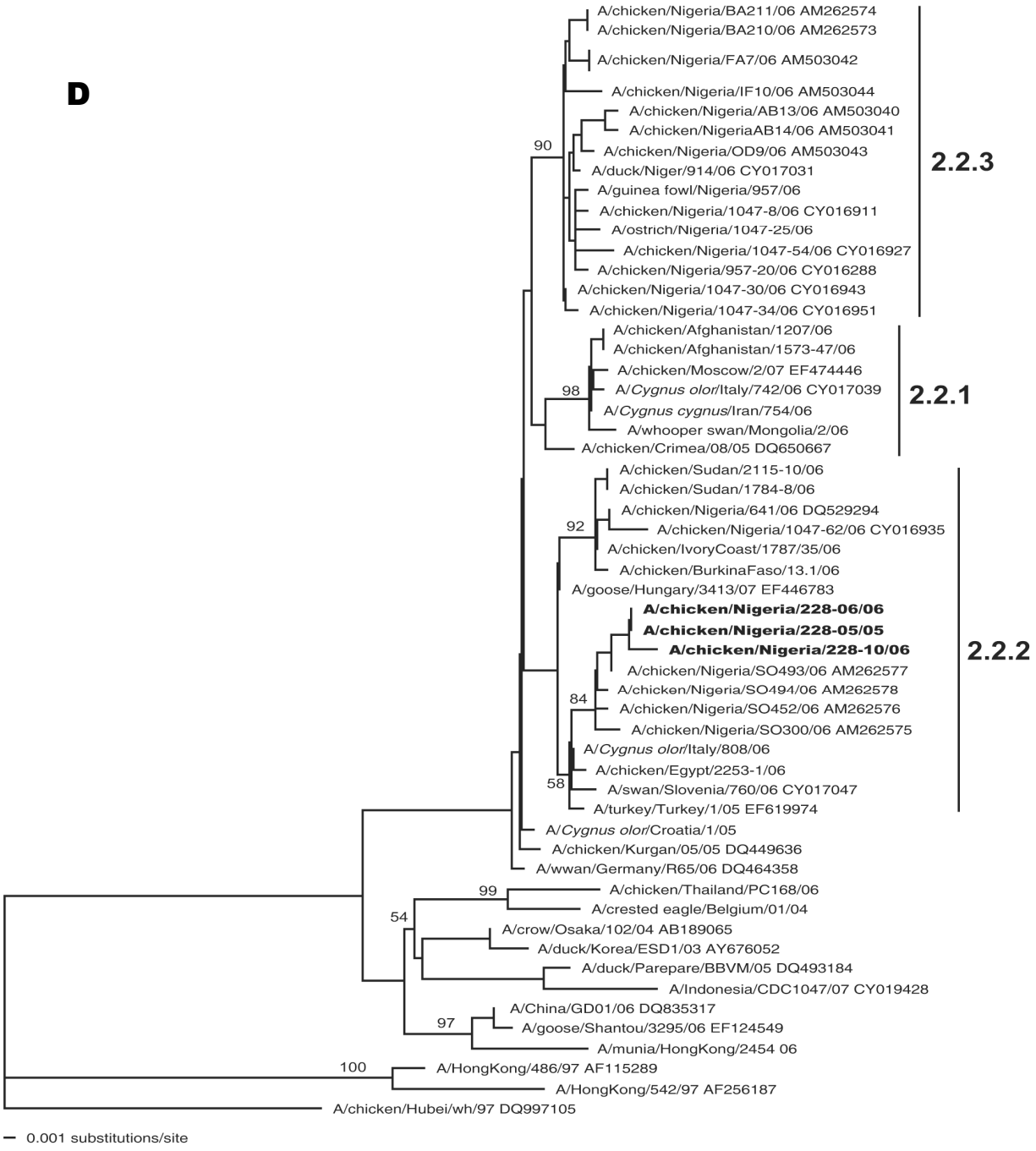
2. Swofford DL. PAUP* (Phylogenetic analysis using parsimony) (* and other methods), version 4. Sunderland (MA): Sinauer Associates; 2002.

3. Felsenstein J. Confidence limits on phylogenies: an approach using the bootstrap. Evolution. 1985;39:783–91. DOI: 10.2307/2408678


A
A/chicken/Afghanistan/1207/06
A/chicken/Afghanistan/1573/47/06
A/whooper swan/Mongolia/2/06
A/chicken/Moscow/2/07 EF474450
A/Cygnus cygnus/Iran/754/06
A/Cygnus olor/Italy/742/06 CY017035
2.2.1
A/chicken/Egypt/2253-1/06
A/chicken/Nigeria/228-5/05
A/chicken/Nigeria/228-6/06
A/chicken/Nigeria/228-10/06
A/chicken/Nigeria/SO300/06 AM262546
A/chicken/Nigeria/SO452/06 AM262547
A/chicken/Nigeria/SO494/06 AM262572
A/chicken/Nigeria SO493 06 AM262553
A/swan/Slovenia/760/06 CY017043
A/turkey/Turkey/1/05 EF619980
A/Cygnus olor/Italy/808/06
A/goose/Hungary/3413/07 EF446779
A/chicken/BurkinaFaso/13.1
A/chicken/IvoryCoast/1787-35/06
A/chicken/Nigeria/641/06 CY016276
A/chicken/Sudan/1784-8/06
A/chicken/Sudan/2115-10/06
A/chicken/Nigeria/1047-62/06 CY016931
A/chicken/Kurgan/05/05 DQ449632
A/chicken/Crimea/08/05 DQ650663
2.2.2
A/chicken/Nigeria/BA210/06 AM262542
A/chicken/Nigeria/BA211/06 AM262543
A/chicken/Nigeria/1047-34/06 CY016947
A/chicken/Nigeria/IF10-06 AM503001
A/chicken/Nigeria/1047-30/06 CY016939
A/chicken/Nigeria/1047-8/06 CY016907
A/guinea fowl/Nigeria/957-12/06
A/chicken/Nigeria/957-20/06 CY016284
A/ostrich/Nigeria/1047-25/06
A/chicken/Nigeria/1047-54/06 CY016923
A/duck/Niger/914/06 CY017027
A/chicken/Nigeria/FA7/06 AM502999
A/chicken/Nigeria/AB13/06 AM503002
A/chicken/Nigeria/AB14/06 AM503003
A/chicken/Nigeria/OD9/06 AM503000
A/Cygnus olor/Croaia/1/05
A/swan/Germany/R65/06 DQ464354
2.2.3
A/crow/Osaka/102/04 AB189061
A/duck/Korea/ESD1 03 AY676036
A/duck/Parepare/BBVM/05 DQ497659
A/Indonesia/CDC1047/07 CY019424
A/China/GD01/06 DQ835313
A/goose/Shantou/3295/06 DQ992784
A/munia/Hong Kong/2454/06
A/chicken/Thailand/PC168/06
A/crested eagle/Belgium/01/04
A/chicken/Hubei/wh/97 DQ997102
A/HongKong/486/97 AF084281
A/HongKong/542/97 AF102678
90
96
100
70
82
100
100
100
0.001 substitutions/site


B
A/chicken/Nigeria/FA7/06 AM503018
A/chicken/Nigeria/BA210/06 AM503022
A/chicken/Nigeria/BA211/06 AM262565
A/chicken/Nigeria/BA210/06 AM262564
A/ostrich/Nigeria/1047-25/06
A/guinea fowl/Nigeria/957-12/06
A/chicken/Nigeria/1047-8/06 CY016909
A/chicken/Nigeria/1047-62/06 CY016933
A/chicken/Nigeria/1047-34/06 CY016949
A/duck/Niger/914/06 CY017029
A/chicken/Nigeria/1047-30/06 CY016941
A/chicken/Nigeria/1047-54/06 CY016925
A/chicken/Nigeria/OD9/06 AM503019
A/chicken/Nigeria/IF10/06 AM503024
A/chicken/Nigeria/957-20/06 CY016286
A/chicken/Nigeria/AB14/06 AM503025
A/chicken/Nigeria/AB13/06 AM503020
A/swan/Germany/R65/06 DQ464355
A/Cygnus olor/Croatia/1/05
2.2.3
A/chicken/Nigeria/228-10/06
79
A/chicken/Nigeria/SO452/06 AM262561
A/chicken/Nigeria/228-6/06
A/chicken/Nigeria/228-5/05
A/chicken/Nigeria/SO493/06 AM262562
A/chicken/Nigeria/SO300/06 AM262560
A/chicken/Nigeria/SO494/06 AM262563
100
A/chicken/Egypt/2253-1/06
A/swan/Slovenia/760/06 CY017045
A/turkey/Turkey/1/01 EF619973
A/Cygnus olor/Italy/808/06
A/goose/Hungary/3413/07 EF446781
A/chicken/Sudan/1784-8/06
A/chicken/Sudan/2115-10/06
A/chicken/BurkinaFaso/13.1/06
A/chicken/Nigeria/641/06 CY016278
A/chicken/IvoryCoast/1787-35/06
A/chicken/Kurgan/05/05 DQ449634
A/chicken/Crimea/08/05 DQ650665
2.2.2
A/Cygnus olor/Italy/742/06 CY017037
A/Cygnus cygnus/Iran/754/06
A/chicken/Moscow/2/07 EF474448
A/whooper swan/Mongolia/2/06
A/chicken/Afghanistan/1207/06
A/chickenAfghanistan/1573-47/06
2.2.1
A/duck/Korea/ESD1/03 AY676044
A/crow/Osaka/102/04 AB189063
A/crested eagle/Belgium/01/04
A/chicken/Thailand/PC168/06
100
A/duck/Parepare/BBVM/05 DQ493008
A/Indonesia/CDC1047/07 CY019426
A/China/GD01/06 DQ835315
A/munia/HongKong/2454/06
A/goose/Shantou/3295/06 EF124247
A/chicken/Hubei/wh/97 DQ997103
A/HongKong/486/97 AF084275
A/HongKong/542/97 AF102670
0.005 substitutions/site


c
A/chicken/Nigeria/228-10/06
A/chicken/Nigeria/228-6/06
A/chicken/Nigeria/228-5/05
A/chicken/Nigeria/SO493/06 AM262558
A/chicken/Nigeria/SO300/06 AM262556
A/chicken/Nigeria/SO452/06 AM262557
A/chicken/Nigeria/SO494/06 AM262559
A/turkey/Turkey/1/05 EF619977
A/chicken/Egypt/2253-1/06
A/swan/Slovenia/760/06 CY017046
A/Cygnus olor/Italy/808/06
A/goose/Hungary/3413/07 EF446780
A/chicken/Sudan/1784-8/06
A/chicken/Sudan/2115-10/06
A/chicken/Nigeria/641/06 CY016279
A/chicken/Nigeria/1047-6/06 CY016934
A/chicken/Burkina Faso/13.1/06
A/chicken/IvoryCoast/1787-35/06
A/chicken/Crimea/08/05 DQ650666
A/chicken/Kurgan/05/05 DQ449635
A/chicken/Afghanistan/1207/06
A/chicken/Afghanistan/1573-47/06
A/Cygnus cygnus/Iran/06
A/Cygnus olor/Italy/742 /6 CY017038
A/chicken/Moscow/2/07 EF474447
A/whooper swan/Mongolia/2/06
A/chicken/Nigeria/1047/34/06 CY016950
A/chicken/Nigeria/1047-8/06 CY016910
A/chicken/Nigeria/1047-30/06 CY016942
A/ostrich/Nigeria/1047-25/06
A/chicken/Nigeria/957-20/06 CY016287
A/duck/Niger/914/06 CY017030
A/guinea fowl/Nigeria/957-12/06
A/chicken/Nigeria/AB14/06 AM503034
A/chicken/Nigeria/AB13-06 AM503030
A/chicken/Nigeria/BA210/06 AM262554
A/chicken/Nigeria/BA211/06 AM262555
A/chicken/Nigeria/OD9/06 AM503032
A/chicken/Nigeria/IF10/06 AM503033
A/chicken/Nigeria/1047-54/06 CY016926
A/chicken/Nigeria/FA7/06 AM503035
A/Cygnus olor/Croatia/1/05
A/swan/Germany/R65/06 DQ464359
A/crow/Osaka/102/04 AB189062
A/duck/Korea/ESD1/03 AY676040
A/China/GD01/06 DQ835314
A/munia/HongKong/2454/06
A/goose/Shantou/3295/06 EF124398
A/duck/Parepare/BBVM/05 DQ493096
A/Indonesia/CDC1047/07 CY019425
A/crested eagle/Belgium/01/04
A/chicken/Thailand/PC168/06
A/chicken/Hubei/wh/97 DQ997104
A/HongKong/486/97 AF115285
A/HongKong/542/97 AF255752
57
96
66
100
100
94
84
100
2.2.2
2.2.1
2.2.3
0.001 substitutions/site


D
A/chicken/Nigeria/BA211/06 AM262574
A/chicken/Nigeria/BA210/06 AM262573
A/chicken/Nigeria/FA7/06 AM503042
A/chicken/Nigeria/IF10/06 AM503044
A/chicken/Nigeria/AB13/06 AM503040
A/chicken/NigeriaAB14/06 AM503041
A/chicken/Nigeria/OD9/06 AM503043
A/duck/Niger/914/06 CY017031
A/guinea fowl/Nigeria/957/06
A/chicken/Nigeria/1047-8/06 CY016911
A/ostrich/Nigeria/1047-25/06
A/chicken/Nigeria/1047-54/06 CY016927
A/chicken/Nigeria/957-20/06 CY016288
A/chicken/Nigeria/1047-30/06 CY016943
A/chicken/Nigeria/1047-34/06 CY016951
90
2.2.3
A/chicken/Afghanistan/1207/06
A/chicken/Afghanistan/1573-47/06
A/chicken/Moscow/2/07 EF474446
A/Cygnus olor/Italy/742/06 CY017039
98
A/Cygnus cygnus/Iran/754/06
A/whooper swan/Mongolia/2/06
A/chicken/Crimea/08/05 DQ650667
2.2.1
A/chicken/Sudan/2115-10/06
A/chicken/Sudan/1784-8/06
A/chicken/Nigeria/641/06 DQ529294
A/chicken/Nigeria/1047-62/06 CY016935
92
A/chicken/IvoryCoast/1787/35/06
A/chicken/BurkinaFaso/13.1/06
A/goose/Hungary/3413/07 EF446783
A/chicken/Nigeria/228-06/06
A/chicken/Nigeria/228-05/05
A/chicken/Nigeria/228-10/06
A/chicken/Nigeria/SO493/06 AM262577
A/chicken/Nigeria/SO494/06 AM262578
84
A/chicken/Nigeria/SO452/06 AM262576
A/chicken/Nigeria/SO300/06 AM262575
A/Cygnus olor/Italy/808/06
A/chicken/Egypt/2253-1/06
58
A/swan/Slovenia/760/06 CY017047
A/turkey/Turkey/1/05 EF619974
2.2.2
A/Cygnus olor/Croatia/1/05
A/chicken/Kurgan/05/05 DQ449636
A/wwan/Germany/R65/06 DQ464358
99
A/chicken/Thailand/PC168/06
A/crested eagle/Belgium/01/04
54
A/crow/Osaka/102/04 AB189065
A/duck/Korea/ESD1/03 AY676052
A/duck/Parepare/BBVM/05 DQ493184
A/Indonesia/CDC1047/07 CY019428
A/China/GD01/06 DQ835317
97
A/goose/Shantou/3295/06 EF124549
A/munia/HongKong/2454 06
100
A/HongKong/486/97 AF115289
A/HongKong/542/97 AF256187
A/chicken/Hubei/wh/97 DQ997105
0.001 substitutions/site