

Supplementary Appendix 7

Various measures necessary for evolutionary rate calculation based on dataset of present study are showing. The procedure of evolutionary rates calculation followed Brusatte (2011). Branch numbers correspond to that of Supplemental Appendix 8.

| Branch to | Character Change | Missing Data | Comparable Character | Time Duration | Patristic Dissimilarity | Rate |
|-----------------------|------------------|--------------|----------------------|---------------|-------------------------|--------|
| <i>Archaeopteryx</i> | 0 | 31 | 208 | 1 | 0 | 0 |
| <i>Protopteryx</i> | 0 | 149 | 90 | 7.367 | 0 | 0 |
| <i>Pengornis</i> | 0 | 111 | 128 | 28.017 | 0 | 0 |
| <i>Apsaravis</i> | 12 | 64 | 175 | 65.372 | 0.06857 | 0.001 |
| <i>Gansus</i> | 2 | 32 | 207 | 7.711 | 0.00966 | 0.0013 |
| <i>Enaliornis</i> | 1 | 157 | 82 | 6.654 | 0.0122 | 0.0018 |
| <i>Pasquiaornis</i> | 3 | 74 | 165 | 4.775 | 0.01818 | 0.0038 |
| <i>Chupkaornis</i> | 0 | 221 | 18 | 5.25 | 0 | 0 |
| <i>Brodavis</i> | 1 | 152 | 87 | 10.65 | 0.01149 | 0.0011 |
| <i>Baptornis</i> | 1 | 76 | 163 | 5 | 0.00613 | 0.0012 |
| <i>Fumicollis</i> | 2 | 106 | 133 | 3.75 | 0.01504 | 0.004 |
| <i>Paraesperornis</i> | 0 | 40 | 199 | 2.5 | 0 | 0 |
| <i>H. regalis</i> | 1 | 41 | 198 | 1.25 | 0.00505 | 0.004 |
| <i>H. gracilis</i> | 0 | 143 | 96 | 1.25 | 0 | 0 |
| <i>Ichthyornis</i> | 6 | 21 | 218 | 20.429 | 0.02752 | 0.0013 |
| <i>Lithornis</i> | 3 | 11 | 228 | 9.55 | 0.01316 | 0.0014 |
| <i>Vegavis</i> | 2 | 177 | 62 | 6.116 | 0.03226 | 0.0053 |
| <i>Crypturellus</i> | 3 | 5 | 234 | 59.5 | 0.01282 | 0.0002 |
| <i>Chauna</i> | 7 | 5 | 234 | 81.281 | 0.02991 | 0.0004 |
| <i>Anas</i> | 0 | 5 | 234 | 75.166 | 0 | 0 |
| <i>Gallus</i> | 0 | 4 | 235 | 34.525 | 0 | 0 |
| <i>Phasianus</i> | 0 | 6 | 233 | 34.525 | 0 | 0 |
| 23 | 3 | 0 | 239 | 7.367 | 0.01255 | 0.0017 |
| 24 | 0 | 0 | 239 | 7.367 | 0 | 0 |
| 25 | 23 | 0 | 239 | 7.711 | 0.09623 | 0.0125 |
| 26 | 14 | 0 | 239 | 7.711 | 0.05858 | 0.0076 |
| 28 | 8 | 0 | 239 | 6.654 | 0.03347 | 0.005 |
| 27 | 8 | 0 | 239 | 6.654 | 0.03347 | 0.005 |

| | | | | | | |
|----|----|---|-----|--------|---------|--------|
| 29 | 3 | 0 | 239 | 11.429 | 0.01255 | 0.0011 |
| 30 | 2 | 0 | 239 | 10.025 | 0.00837 | 0.0008 |
| 31 | 1 | 0 | 239 | 6.5 | 0.00418 | 0.0006 |
| 32 | 1 | 0 | 239 | 1.25 | 0.00418 | 0.0033 |
| 33 | 5 | 0 | 239 | 1.25 | 0.02092 | 0.0167 |
| 34 | 32 | 0 | 239 | 1.25 | 0.13389 | 0.1071 |
| 35 | 7 | 0 | 239 | 1.25 | 0.02929 | 0.0234 |
| 36 | 8 | 0 | 239 | 20.429 | 0.03347 | 0.0016 |
| 37 | 5 | 0 | 239 | 34.013 | 0.02092 | 0.0006 |
| 38 | 22 | 0 | 239 | 6.116 | 0.09205 | 0.0151 |
| 39 | 2 | 0 | 239 | 6.116 | 0.00837 | 0.0014 |
| 40 | 4 | 0 | 239 | 6.116 | 0.01674 | 0.0027 |
| 41 | 6 | 0 | 239 | 6.116 | 0.0251 | 0.0041 |
| 42 | 5 | 0 | 239 | 52.872 | 0.02092 | 0.0004 |