

## 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