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SUPPLEMENTARY DATA

Craniodental and postcranial morphology of *Indohyaenodon raoi* from the early Eocene of India, and its implications for ecology, phylogeny, and biogeography of hyaenodontid mammals

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APPENDIX S1. CHARACTER LIST

1. First mental foramen (from Solé, 2013): (0) below p1 or (1) below p2.
2. Second mental foramen (from Solé, 2013): (0) below p3 or (1) below p4.
3. Premolar diastemata (modified from Solé, 2013): (0) premolar series crowded, no diastema between p2 and p3, gap between c and p2 small or (1) small diastema between p2 and p3, gap between c and p2 small or (2) large diastema between p2 and p3, gap between c and p2 small or (3) large diastema between p2 and p3, gap between c and p2 large or (4) no diastema between p2 and p3, large gap between c and p2.
4. Enamel (from Solé, 2013): (0) enamel thin and smooth or (1) crenulated.
5. p1 presence (from Solé, 2013): (0) present or (1) absent.
6. p1 roots (from Solé, 2013): (0) two-rooted or (1) single-rooted.
7. p2 talonid development (from Solé, 2013): (0) talonid short or (1) talonid elongated and cutting.
8. Relative heights of p2 and p3 (from Solé, 2013): (0) p2 lower than p3 or (1) p2 as high as p3 or (2) p2 higher than p3.
9. p3 talonid development (from Solé, 2013): (0) talonid short or (1) talonid long.
10. p3 entoconid presence (from Solé, 2013): (0) entoconid absent or (1) entoconid present.
11. Relative lengths of p3 and p4 (from Solé, 2013): (0) p3 shorter than p4 or (1) p3 longer than p4.
12. p4 paraconid development (modified from Solé, 2013): (0) paraconid small or absent or (1) paraconid well-developed.
13. p4 metaconid development (from Solé, 2013): (0) metaconid absent or (1) metaconid present but weakly developed (= metaconid ridge).
14. p4 buccal talonid cusps (modified from Solé, 2013): (0) only one well-developed cusp present or (1) two subequal cusps present.
15. p4 entoconid presence (from Solé, 2013): (0) absence of an entoconid or (1) presence of an entoconid.
16. p4 accessory cusp presence (from Solé, 2013): (0) absence of an accessory cusp or (1) presence of an accessory cusp.
17. p4 hypoconid development (from Solé et al., 2014): (0) hypoconid low or (1) hypoconid high and secant.
18. p4 talonid basin development (from Solé et al., 2014): (0) talonid narrow and shallow or (1) talonid wide and deep postfossid.
19. p4 cingulid development (from Solé, 2013): (0) absence of cingulid or (1) presence of precingulid and postcingulid.
20. p4 inflation (modified from Solé, 2013): (0) compressed transversely or (1) inflated transversely, only on the talonid part or (2) inflated transversely in mesial and distal part.
21. p4 height (modified from Solé, 2013): (0) p4 protoconid very low or (1) p4 protoconid taller, but height than p4 length or (2) p4 height greater than length.
22. Lower molars (from Solé, 2013): (0) paraconid poorly mesially located or (1) paraconid mesially located or (2) paraconid very mesially located.

APPENDIX S1. (CONTINUED)

23. m2 metaconid position (states rearranged from from Solé, 2013): (0) disto-lingual to the protoconid or (1) directly lingual to the protoconid or (2) mesio-lingual to the protoconid.
24. Development of m2 metaconid (from Solé, 2013): (0) metaconid taller than paraconid or (1) metaconid subequal to paraconid height or (2) metaconid lower than paraconid or (3) metaconid absent.
25. Lower molars (from Solé et al., 2014): (0) paraconid small or enlarged or (1) paraconid strongly reduced.
26. m1 and m2 entoconid development (modified from Solé, 2013): (0) entoconid or entocristid as tall as hypoconid or (1) entoconid or entocristid present but lower than hypoconid or (2) entoconid and entocristid strongly reduced or absent, talonid trenchant.
27. m1 and m2 entoconid shape (modified from Solé, 2013): (0) entoconid well developed (= bulbous) or (1) entoconid reduced, crestiform with a visible apex.
28. m1 and m2 distal talonid margin (from Solé, 2013): (0) distal part of the talonid convex with hypoconulid inflated and salient distally or (1) distal part of the talonid almost straight with hypoconulid poorly inflated.
29. m1 and m2 talonid basin (postfossid) width (from Solé, 2013): (0) postfossid narrow or (1) postfossid wide.
30. m1 and m2 talonid basin (postfossid) depth (from Solé, 2013): (0) postfossid deep or (1) postfossid shallow.
31. m1 and m2 talonid width (from Solé, 2013): (0) talonid narrow or (1) talonid wide.
32. Relative sizes of m1 and m2 (from Solé, 2013): (0) m1 subequal or longer than the m2 or (1) m1 shorter than the m2.
33. m3 size (from Solé, 2013): (0) m3 subequal or slightly longer or smaller than the m2 or (1) m3 distinctly smaller than the m2 or (2) m3 absent.
34. Lower molar trigonid heights (from Solé, 2013): (0) trigonid high or (1) trigonid low on all molars or (2) trigonid low on m1 and m2.
35. Lower molars (from Solé, 2013): (0) talonid oblique with respect to the mesio-distal axis or (1) talonid not oblique with respect to the mesio-distal axis.
36. Lower molar cingulid development (modified from Solé, 2013 and Solé et al., 2014): (0) buccal cingulids very weak or absent on lower molars or (1) ectocingulid well-developed but postcingulid absent or (2) postcingulid well-developed but ectocingulid absent or (3) ecto- and postcingulids well-developed but separate or (4) ecto- and postcingulids well developed and continuous to form a complete buccal cingulid.
37. Lower molar buccal enamel distention (states rearranged from from Solé, 2013): (0) very strong or (1) moderately developed or (2) reduced.
38. P3 protocone lobe development (from Solé, 2013): (0) lobe of the protocone absent or (1) lobe of the protocone present but small or (2) protocone well developed and invividualized.
39. P3 roots (from Solé et al., 2014): (0) p3 double-rooted or (1) P3 three-rooted.
40. P4 parastyle development (states rearranged from from Solé, 2013): (0) parastyle very reduced to absent or (1) parastyle present, but small or (2) parastyle strong.

APPENDIX S1. (CONTINUED)

41. P4 protocone position (from Solé, 2013): (0) protocone aligned transversely with the paracone or (1) protocone shifted mesially versus paracone.
42. Separation of P4 protocone from paracone (states rearranged from from Solé, 2013): (0) protocone bulbous and separated from the paracone or (1) protocone poorly separated from the paracone.
43. P4 lingual accessory cusps (from Solé, 2013): (0) absence of accessory cusps in the protocone area or (1) presence of accessory cusps in the protocone area.
44. P4 metastyle development (from Solé et al., 2014): (0) short metastyle or (1) elongated metastyle.
45. M1 and M2 postmetacrista (modified from Solé, 2013): (0) straight with carnassial notch between metacone and metastyle portions or (1) arcuate without carnassial notch.
46. M1 and M2 metastyle length (from Egi et al., 2005): (0) metastyle short (the carnassial blade shorter than the parametacrista) or (1) metastyle medium or (2) metastyle elongated (the carnassial blade longer than one and a half length of the parametacrista).
47. M1 parastyle lobe development (from Egi et al., 2005): (0) parastyle lobe prominent and buccally directed or (1) parastyle lobe prominent and mesially directed or (2) parastyle lobe reduced and mesially directed.
48. M2 parastyle lobe development (modified from Solé, 2013): (0) parastyle lobe prominent and buccally directed, with a distinct stylocone as well as paracone or (1) parastylar lobe reduced, stylocone absent or poorly developed.
49. M1 and M2 buccal cusp height (from Solé, 2013): (0) paracone higher than metacone or (1) paracone as high or lower than metacone.
50. M1 and M2 buccal cusp fusion (states rearranged from from Solé, 2013): (0) paracone and metacone separate almost at basis or (1) paracone and metacone fused up to mid-height or (2) paracone and metacone almost or completely fused.
51. M1 and M2 size (from Solé, 2013): (0) M1 subequal or larger than the M2 or (1) M1 smaller than the M2.
52. M1 and M2 postparaconule crista (from Solé, 2013): (0) postparaconule crista present or (1) postparaconule crista absent.
53. M1 and M2 premetaconule crista (from Solé, 2013): (0) premetaconule crista present or (1) premetaconule crista absent.
54. M1-2 metacingulum length (from Solé, 2013): (0) metacingulum long, extends along base of metastyle or (1) metacingulum short, terminating at base of metacone.
55. M1-2 metaconule (from Solé et al., 2014): (0) present or (1) absent as a definable cusp.
56. M1 and M2 mesial and distal cingulum development (from Solé, 2013): (0) mesial and distal cingulum absent on M1 and M2 or (1) mesial and distal cingulum present on M1 and M2 or (2) mesial and distal cingulum absent on M2 but present on M1.
57. M1 and M2 lingual cingulum development (from Solé, 2013): (0) precingulum and postcingulum separated or (1) precingulum and postcingulum fused lingually.
58. M1 and M2 protocone position (from Solé, 2013): (0) protocone centered transversely with respect to the position of the paracone and the metacone or (1) protocone markedly shifted mesially at least at paracone level.

APPENDIX S1. (CONTINUED)

59. M1 and M2 protocone height (modified from Solé, 2013): (0) protocone high or (1) protocone low.
60. Separation of M1-2 protocones from buccal cusps (from Solé et al., 2014): (0) M1-2 protocones well lingual to buccal cusps or (1) M1-2 protocones closely appressed to buccal cusps.
61. M3 metacone (from Solé, 2013): (0) metacone present and lower than the paracone or (1) metacone absent.
62. M3 size (from Solé, 2013): (0) M3 subequal to the M1 and M2 or (1) M3 slightly smaller than M1 and M2 or (2) M3 much smaller than M1 and M2 or (3) M3 absent.
63. Prefossa/postfossid shearing (from Solé et al., 2014): (0) absent or (1) present.
64. Humerus: cross section slightly just above the supinator crest (from Polly, 1996): (0) triangular shaped or (1) round.
65. Humerus: supinator crest development (states rearranged from from Polly, 1996): (0) enlarged or (1) medium sized or (2) reduced.
66. Humerus: medial epicondyle development (from Polly, 1996): (0) large or (1) reduced.
67. Ulna: radial notch orientation (from Polly, 1996): (0) curved and laterally facing or (1) flattened and anteriorly facing.
68. Femur: third trochanter development (from Polly, 1996): (0) small (flush with shaft) or (1) large (projecting).
69. Astragalus: astragalar foramen development (from Polly, 1996): (0) large or (1) reduced.
70. Astragalus: lateral border height (from Polly, 1996): (0) subequal in height to medial border or (1) raised relative to medial border.
71. Astragalus: head orientation (from Polly, 1996): (0) oriented horizontally or (1) angled more vertically.
72. Calcaneum: heel for the attachment of the Achilles tendon (from Polly, 1996): (0) angled medially or (1) oriented vertically.
73. Calcaneum: plane of the distal calcaneal (cuboid) facet (from Polly, 1996): (0) angled medially or (1) angled medially and ventrally.
74. Calcaneum: peroneal tubercle size (from Polly, 1996): (0) large or (1) reduced.
75. Calcaneum: calcaneal ectal facet orientation (from Polly, 1996): (0) angled obliquely to the long axis of the calcaneum or (1) more parallel with the axis of the calcaneum.
76. Calcaneum: calcaneal cuboid facet dorsal lip (from Polly, 1996): (0) without a process on the dorsal lip or (1) with the process.
77. Calcaneum: protuberance of the dorsal border of the cuboid facet (from Polly, 1996): (0) positioned on the longitudinal axis of the calcaneum or (1) positioned medially to the axis.
78. Nuchal crest shape (from Polly, 1996): (0) extending from apex of skull to mastoid process or (1) extending ventrally towards the foramen magnum and ending dorsolateral to it.
79. Facial wing of lacrimal size (from Polly, 1996): (0) large or (1) reduced.
80. Genioglossus attachment and symphysis orientation (from Polly, 1996): (0) at the base of a horizontal mandibular symphysis or (1) halfway up a vertical symphysis.

APPENDIX S1. (CONTINUED)

- 81. Position of hypoglossal foramen (from Polly, 1996): (0) separated from occipital condyles or (1) positioned posteriorly within the curve of the occipital condyles.
- 82. Fenestra rotundum size (from Polly, 1996): (0) slightly larger than fenestra ovale or (1) very large in comparison.
- 83. Fenestra rotundum orientation (from Polly, 1996): (0) faces posteriorly or (1) faces slightly laterally.
- 84. Bridge of the foramen stylomastoid primitivum (from Polly, 1996): (0) absent or slender or (1) robust or (2) completely roofed with a secondary stylomastoid foramen.
- 85. Mastoid sinus lateral to the foramen stylomastoid primitivum (from Polly, 1996): (0) absent or (1) present.
- 86. Ridge of bone dividing the posterior petrosal sinus from the foramen stylomastoid primitivum (from Polly, 1996): (0) present or (1) reduced or absent.
- 87. Posterior petrosal sinus (from Polly, 1996): (0) absent or (1) small or (2) greatly inflated¹.
First mental foramen (from Solé, 2013): (0) below p1 or (1) below p2.

APPENDIX S2. MATERIALS EXAMINED

List of materials used to construct the character taxon matrix. **Institutional abbreviations** (excluding those given in the main text)—**CGM**, Cairo Geological Museum, Cairo, Egypt; **CM**, Carnegie Museum of Natural History, Pittsburgh, Pennsylvania; **F:AM**, Frick Collection, American Museum of Natural History, New York; **GMH**, Geiseltalmuseum der Martin Luther-Universität, Halle, Germany; **MNHN**, Muséum national d'Histoire naturelle, Paris, France; **NMMP-KU**, National Museum of Myanmar, Kyoto University, Yangon, Myanmar; **NSM**, National Science Museum, Tokyo, Japan; **UCMP**, University of California, Museum of Paleontology, Berkeley, California; **UM**, Museum of Paleontology, University of Michigan, Ann Arbor, Michigan; **UW**, University of Wyoming Geological Museum, University of Wyoming, Laramie, Wyoming; **WIF/A**, Wadia Institute fossil collection, Wadia Institute of Himalayan Geology, Dehradun, India; **YPM**, Yale Peabody Museum, Yale University, New Haven, Connecticut; **YPM-PU**, Princeton University collection, Yale Peabody Museum, Yale University, New Haven, Connecticut.

Maelestes gobiensis: Wible et al. (2009)

Cimolestes magnus: Lillegraven (1969)

Tinherodon disputatum: Gheerbrant et al. (2006)

Boualitomus marocanensis: Gheerbrant et al. (2006)

Lahimia selloumi: Solé et al. (2009)

Koholia atlasense: Crochet (1988a)

'Proviverra' eisenmanni: Godinot (1981)

Oxyaenoides bicuspidens: GMH XIV-2848; Crochet et al. (1976); Lange-Badré and Haubold (1990); Morlo and Habersetzer (1999)

Eurotherium spp.: Polly (1996)

E. matthesi: GMH XIV-3419; Lange-Badré and Haubold (1990)

E. theriodis: Van Valen (1965)

Prodissopsalis eocaenicus: GMH VI-91; Lange-Badré and Haubold (1990)

Leonhardtina gracilis: Lange-Badré and Haubold (1990)

Proviverra typica: UCMP 140641, 140642, 140643; Van Valen (1965); Lange-Badré and Haubold (1990); Polly (1996)

Allopterodon spp.

A. bulbosus: Lange-Badré (1979); Lange-Badré and Mathis (1992)

A. minor: Lange-Badré (1979); Lange-Badré and Mathis (1992)

Cynohyaenodon cayluxi: AMNH 11050, 11052, 11054, 11055, 11056; Lange-Badré (1979); Lange-Badré and Mathis (1992)

Paracynohyaenodon spp.

P. magnus: Crochet (1988b, 1991); Lange-Badré and Mathis (1992)

P. schlosseri: Lange-Badré (1979); Crochet (1991)

Quercytherium spp.

Q. simplicidens: MNHN Qu 8642; Lange-Badré (1979); Crochet (1991)

Q. tenebrosum: Lange-Badré (1979); Crochet (1991)

Morlodon vellerei: Solé (2013)

APPENDIX S2. (CONTINUED)

Matthodon tritens: Lange-Badré and Haubold (1990); Morlo and Habersetzer (1999)

Indohyaenodon raoi: see text

Paratritemnodon indicus: WIF/A 1102, 1103; Ranga Rao (1973); Kumar (1992)

Kyawdawia lupina: NMMP-KU 0042, 1161; Egi et al. (2005); Peigné et al. (2007)

Glibzegdouia tabelbalaensis: Solé et al. (2014)

Masrasector spp.

M. aegypticum: CGM 30978, YPM 20944, 30019, 30020, 30030

M. ligabuei: Crochet et al. (1990); Holroyd (1994)

Teratodon spp.

T. enigma: Savage (1965)

T. spekei: Savage (1965)

African "Sinopa" spp.:

'S.' *aethiopica*: Holroyd (1994)

'S.' n. sp.: Holroyd (1994)

Anasinopa leakeyi: M.19081; Savage (1965)

Dissopsalis spp.

D. carnifex: AMNH 19401, 19402, 93027; Colbert (1933); Barry (1988)

D. pyroclasticus: Savage (1965); Barry (1988)

Furodon crocheti: Solé et al. (2014)

Metapterodon spp.

M. brachycephalus: Osborn (1909); Holroyd (1999)

M. markgrafi: Holroyd (1999)

M. ?kaiseri: Savage (1965)

M. schlosseri: Holroyd (1999)

M. zadoki: Savage (1965)

Pterodon spp.: Polly (1996)

P. africanus: Osborn (1909); Holroyd (1999)

P. dasyuroides: NSM DBR-61; Lange-Badré (1979)

P. phiomensis: Osborn (1909); Holroyd (1999)

P. syrtois: Holroyd (1999)

Akhnatenavus leptognathus: Osborn (1909); Holroyd (1999)

Hyainailouros/Megistotherium spp.: Polly (1996)

H. napakensis: Savage (1965)

H. sulzeri: Ginsburg (1980); Morales et al. (1998)

M. osteothlastes: Savage (1973); Rasmussen et al. (1989)

Apterodon macrognathus: AMNH 13236, 13237, 13248, 92794, YPM 18127, 20945, 30035, 33221; Andrews (1906); Osborn (1909); Szalay (1967); Polly (1993)

Galecyon peregrinus: AMNH 56320, USNM 509676, UW 9864, YPM 32230

Galecyon chronius: USGS 9276, 10284, 10374, 15956, 25399, USNM 487920, 511004, 521860, YPM 23341

Prototomus minimus: Smith and Smith (2001); Solé et al. (2013)

Prototomus phobos: UM 68075, 73134, YPM-PU 13019; Gingerich and Deutsch (1989)

APPENDIX S2. (CONTINUED)

- Prototomus secundarius*: USGS 6666, 9066, 9095, USNM 495126; Gingerich and Deutsch (1989)
Gazinocyon whitiae: AMNH 4780, 15606, USNM 19347, 510864, 510979, YPM 29839/29585
Sinopa spp.: Polly (1996)
 S. minor: AMNH 11532
 S. rapax: AMNH 13142; USNM 13305, 13306, 13307, 13309, YPM-PU 10244, YMP 12862
Tritemnodon agilis: AMNH 11536, USNM 11544, 361351, YPM 10073, 11877; Matthew (1906, 1909)
Prototomus martis: UM 67138, USNM 509700, 511037, 511057, 511087, 511088, 511089, 511090, 525550, 527677
Pyrocyon dioctetus: UM 94757
Pyrocyon strenuus: AMNH 4781, USGS 6111, 16474, 16475, 27236, USNM 491821
Arfia gingerichi: Smith and Smith (2001); Solé et al. (2013)
Arfia shoshoniensis/opisthotoma
 A. opisthotoma: UM 63591; Gingerich and Deutsch (1989)
 A. shoshoniensis: CM 39126, UM 69474, 77051, 87768, UW 9915, YPM 36932; Gingerich and Deutsch (1989)
Prolimnocyon spp.: Polly (1996)
 P. atavus: DPC 5364; USGS 9330, 12784, USNM 510977
 P. eerius: Gingerich (1989)
 P. haematus: Gingerich and Deutsch (1989)
Limnocyon spp.
 L. potens: CM 11439
 L. verus: AMNH 12155; Matthew (1909)
Thinocyon spp.: Polly (1996)
 T. medius: AMNH 12154, 13082, YPM 12874, 12881; Morlo and Gunnell (2003)
 T. velox: Morlo and Gunnell (2003)
Propterodon spp.: Polly (1996)
 ‘*Neoparapterodon rechetovi*’: Lavrov (1996)
 P. irdinensis: AMNH 20128; Matthew and Granger (1925)
 P. morrissi: AMNH 21553, 21555
 P. sp.: AMNH 96384
Hyaenodon spp.: Polly (1996)
 H. crucians: AMNH 647, F:AM 75565; Mellett (1977)
 H. mustelinus: Mellett (1977)
 H. raineyi: Gustafson (1986)
 H. venturae: Stock (1933); Lavrov and Emry (1998)

APPENDIX S3. CHARACTER-TAXON MATRIX

Key: **A** = (0&1); **B** = (1&2); **C** = (0&2); **D** = (1&3); **E** = (2&3); **?** = missing data; **-** = inapplicable.

| | | | | | |
|----------------------------------|-------------|--------------|--------------|--------------|-------------|
| <i>Cimolestes magnus</i> | 000000??00 | 0000000001 | 1000100100 | 0001011A10 | 0000100110 |
| | 0001000000 | 0????????? | ???????0?? | ????? | |
| <i>Tinherodon disputatum</i> | 11?0??0000 | 0011100001 | ?000100000 | ?00001???? | |
| | ??0???????? | ??????????? | 0?????????? | ??????????? | ????? |
| <i>Boualitomus maroccanensis</i> | 11101-0000 | 0001100000 | ?0?0110000 | 100001???? | |
| | ??????????? | ??????????? | 1?????????? | ?????????1?? | ????? |
| <i>Lahimia selloumi</i> | 11?01-???? | ??????????? | ?110110000 | 100002???? | ??????????? |
| | ??????????? | 1?????????? | ??????????? | ????? | |
| <i>Koholia atlasense</i> | ??????????? | ??????????? | ??????????? | ?????????00 | 10100?1111 |
| | ?1?0-111?? | 1?????????? | ??????????? | ????? | |
| <i>'Proviverra' eisenmanni</i> | ???0??????? | ??????????? | ?100100001 | 100010???? | |
| | ???02?0111 | 1100-100?? | ??????????? | ?????????1?? | ????? |
| <i>Oxyaenoides bicuspidens</i> | 00B0000000 | 0100101000 | 1230010010 | 100101?0?? | |
| | ???0201211 | 1110-101?? | ??11??????? | ?????????1?? | ????? |
| <i>Eurotherium</i> spp. | 0000001011 | 010010??02 | 111?101100 | 100001A?21 | 01?0211211 |
| | 1101010011 | ???????1111 | 1111101010 | 00?00 | |
| <i>Prodissopsalis eocaenicus</i> | 0000001011 | 010010?102 | 1210101100 | 1001011A21 | |
| | 0100211211 | 11A0-10002 | ??????????? | ?????????0?? | ????? |
| <i>Leonhardtina gracilis</i> | 0000001211 | 110010??00 | 101?001101 | 1000211?21 | 01?0201010 |
| | 11?1110001 | ??????????? | ?????????0?? | ????? | |
| <i>Proviverra typica</i> | 0000001211 | 1100100010 | 1010001101 | 1001311021 | 0100201010 |
| | 1100-10001 | 001?00???? | ??0?????0?? | ????? | |
| <i>Allopteronodon</i> spp. | 0000000201 | 1100100012 | 1110001101 | 1001311021 | 0100211011 |
| | 1101110001 | 0??????????? | ?????????0?? | ????? | |
| <i>Cynohyaenodon cayluxi</i> | 0000000201 | 0100100002 | 1100001101 | 1010011A21 | |
| | 0100211010 | 1101010001 | 0??????????? | ?????0100? | ????? |
| <i>Paracynohyaenodon</i> spp. | 0001000201 | 010010??02 | 111?001101 | 1011010A21 | |
| | 01?0211011 | 1100-10001 | ??????????? | ?????????0?? | ????? |
| <i>Quercytherium</i> spp. | 0001000201 | 010010??02 | 111?001101 | 1001010021 | 01?0211011 |
| | 1100-10001 | ??????????? | ?????01?0? | ????? | |

APPENDIX S3. (CONTINUED)

| | | | | | |
|--|--------------|--------------|-------------|------------|-------------|
| <i>Morlodon vellerei</i> | 0001000000 | 0100100002 | 1100100001 | 100101??21 | 1000200011 |
| 1110-10001 | 0????????? | ??????????? | ????? | | |
| <i>Matthodon tritens</i> | 1001011010 | 010010??02 | 112?100000 | 100001???? | ??????????? |
| ??????????? | ??00??????? | ????????1?? | ????? | | |
| <i>Indohyaenodon raoi</i> | 0000010?00 | 0000000010 | ?120010011 | 1001410020 | 1000210111 |
| 1001A1?101 | 0???0????0 | 00010?00?? | ????? | | |
| <i>Paratritemnodon indicus</i> | 0000????00 | 1000100010 | 2120???0?? | 100?4?0000 | |
| 100021?111 | 101101?111 | 0????????? | ??????????? | ????? | |
| <i>Kyawdawia lupina</i> | ???1????00 | 0000000010 | 1220110001 | 1001410000 | 1000211110 |
| 1001A11101 | 0??0??????? | ????????0?? | ????? | | |
| <i>Glibzegdouia tabelbalaensis</i> | ??????????? | ??????????? | ?120000101 | 1?1011???? | |
| ???0?110?1 | ?00???????? | 0??????????? | ??????????? | ????? | |
| <i>Masrasektor spp.</i> | 000?000100 | 1000100102 | 01200A?101 | 1010110001 | 00002?1011 |
| ?0010101?? | 0??????????? | ????????0?? | ????? | | |
| <i>Teratodon spp.</i> | 000?000100 | 1000100?02 | 002011?101 | 101011?001 | 0000201011 |
| ?001010001 | 0??????????? | ????????1?? | ????? | | |
| African ' <i>Sinopa</i> ' spp. | 000?010000 | 1000101102 | 112011?101 | 1011110001 | 0000??1011 |
| ?000-10?1? | 0??????????? | ??????????? | ????? | | |
| <i>Anasinopa leakeyi</i> | 0001000000 | 0000101102 | 112011?101 | 1011110001 | 0000211011 |
| ?000-100?1 | 0??????????? | ????????0?? | ????? | | |
| <i>Dissopsalis spp.</i> | 0001010000 | 0000101102 | 122011?101 | 1011110001 | 0000211011 |
| ?000-10011 | 0??????????? | ????????0?? | ????? | | |
| <i>Furodon crocheti</i> | 010?010000 | 0000101002 | 122011?010 | 100001???? | ???02?0111 |
| ?100-100?? | 0??????????? | ????????0?? | ????? | | |
| <i>Metapterodon spp.</i> | 110?1-0000 | 0000100002 | 12302-?010 | 1000021000 | 100021?211 |
| ?1A0-10A12 | 0??????????? | ????????0?? | ????? | | |
| <i>Pterodon spp.</i> | 010?A10000 | 0000101002 | 12302-?010 | 1000012100 | 100021?211 |
| 1001? 0110?????0 | 0010?10101 | 100?1 | | | ?110- |
| <i>Akhnatenavus leptognathus</i> | 012?01??00 | 0000000000 | 22302-1?10 | 100001???? | |
| ??????????? | ??????????? | 0??????????? | ????????0?? | ????? | |
| <i>Hyainailouros/Megistotherium spp.</i> | ?1??01??00 | 0000A0A002 | 12302-1010 | 10010?2100 | |
| 100011021- | -110-11112 | 011100?000 | 0110?1?10? | ?0??? | |

APPENDIX S3. (CONTINUED)

| | | | | | |
|--|-------------|-------------|-------------|------------|-------------|
| <i>Apterodon macrognathus</i> | 0001010000 | 0000000012 | 10312-1011 | 1001310000 | |
| 1000211011 | ?000-10111 | 0?10??0000 | 1?00?1010? | ????? | |
| <i>Galecyon peregrinus</i> | ?0?1????10 | 1001001000 | 2110010011 | 010000???? | ??????????? |
| ??????????? | ??????????? | ??????????? | ????? | | |
| <i>Galecyon chronius</i> | 0001011?10 | 0001001002 | 2110010011 | 010000A?21 | 100011010? |
| ?0010111?? | ?0101?0111 | 00000?0?? | ????? | | |
| <i>Prototomus minimus</i> | 00D001???? | ?001000000 | 2010110011 | 100010??10 | 1100200110 |
| 1001001001 | 0????????? | ????????0?? | ????? | | |
| <i>Prototomus phobos</i> | 0030010000 | 0000000010 | 2010110011 | 1000100010 | 11002A0111 |
| 1001111001 | ?????10001 | 000100?0?? | ????? | | |
| <i>Prototomus secundarius</i> | 0030010?00 | ?000000010 | 2010110011 | 100010??A0 | |
| 100020011A | 1001A11001 | ??????????? | ????????0?? | ????? | |
| <i>Gazinocyon whitiae</i> | 0040010000 | 0000100010 | 2010010011 | 1000100010 | 1?0020?111 |
| 1001011001 | ?110101111 | 11011?0?? | ????? | | |
| <i>Sinopa</i> spp. | 0001011000 | 0000010010 | 2010011111 | 1011400000 | 1000201010 |
| 1001111001 | 011010??1? | 0??1100010 | 00000 | | |
| <i>Tritemnodon agilis</i> | 0010011000 | 1000010010 | 2210110011 | 1001100020 | 1000200111 |
| 1001111111 | 0010?0?110 | 0A0??0000? | ????? | | |
| <i>Prototomus martis</i> | 0010011100 | 0000000000 | 2010110011 | 100010??00 | 10?0200110 |
| 1001A11001 | ??????????? | ????????0?? | ????? | | |
| <i>Pyrocyon dioctetus</i> | 0001000210 | 0000000010 | 2110010011 | 100010???? | ???0?0?1?1 |
| 100?1110?? | 0?????????? | ????????0?? | ????? | | |
| <i>Pyrocyon strenuus</i> | 0001000B10 | 0000A000AC | 2110010011 | 1000100010 | 0000201111 |
| 100AA110A1 | 001011?100 | 10010?0?? | ????? | | |
| <i>Arfia gingerichi</i> | ???1????00 | 000010??10 | 101?100101 | 1020D2??11 | 00?1210010 |
| 0001000001 | ??????????? | ??????????? | ????? | | |
| <i>Arfia shoshoniensis/opisthotoma</i> | 0001011110 | 0000100010 | 1010100101 | 1020421111 | |
| 0001211010 | 1001010001 | 0010010010 | 100100?0?? | ????? | |
| <i>Prolimnocyon</i> spp. | 0000010110 | 000000??02 | 101?110000 | 1B00010?10 | 00?0201100 |
| 100200001E | ?00001?000 | 0000??0?1 | 10000 | | |
| <i>Limnocyon</i> spp. | 0000001110 | 000000??02 | 111?110001 | 1201010?11 | 00?0201201 |
| 10A21101?3 | ?000010000 | 0000?0010? | ????? | | |

APPENDIX S3. (CONTINUED)

| | | | | | |
|-------------------------|-------------|------------|------------|------------|------------|
| <i>Thinocyon</i> spp. | 0000001210 | 0A0000??02 | 111?110001 | 1201010?11 | 00?0201201 |
| 10A21100?3 | ?00001?00? | 0000?0000? | ????? | | |
| <i>Propterodon</i> spp. | 000?010?10 | ?000001000 | 2210111010 | 1000101?10 | 0000211211 |
| -110-110?1 | ??????????? | ???????0?? | ????? | | |
| <i>Hyaenodon</i> spp. | 000?010110 | 0000001002 | 22302-?0-0 | 100-10A0A0 | 000021-21- |
| -110-111-3 | ?121101111 | 1111101010 | 02112 | | |

FIGURE S1. Strict consensus of 62 trees (L: 386; CI: 0.29; RI: 0.64) produced by analysis of the character taxon matrix with Indohyaenodontinae constrained to monophyly.

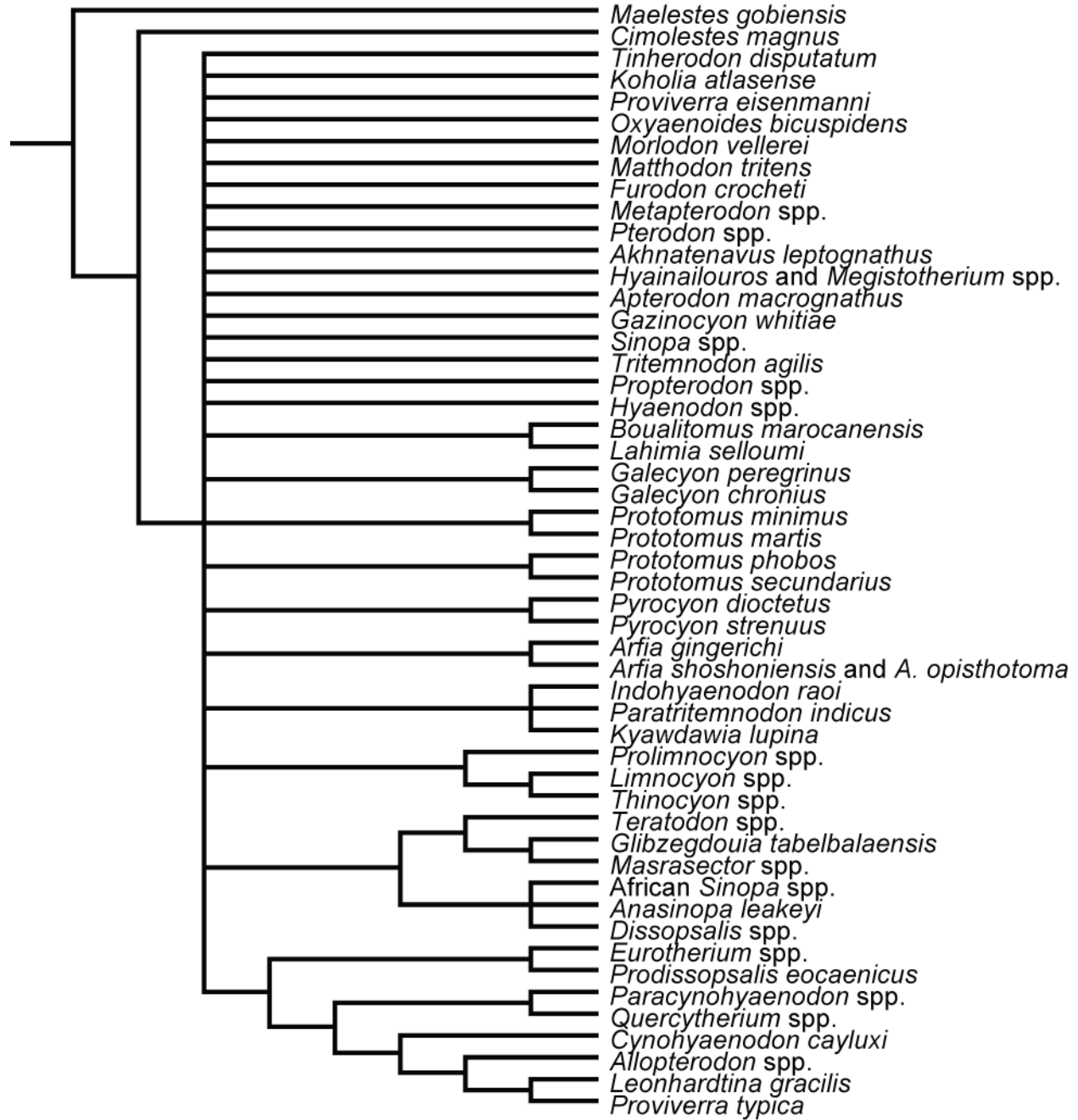


FIGURE S2. Adams consensus of the 62 trees produced by analysis of the character taxon matrix with Indohyaenodontinae constrained to monophyly.



FIGURE S3. Strict consensus of 246 trees (L: 387; CI: 0.29; RI: 0.64) produced by analysis of the character taxon matrix with Proviverrinae constrained to monophyly.



FIGURE S4. Adams consensus of the 246 trees produced by analysis of the character taxon matrix with Proviverrinae constrained to monophyly.

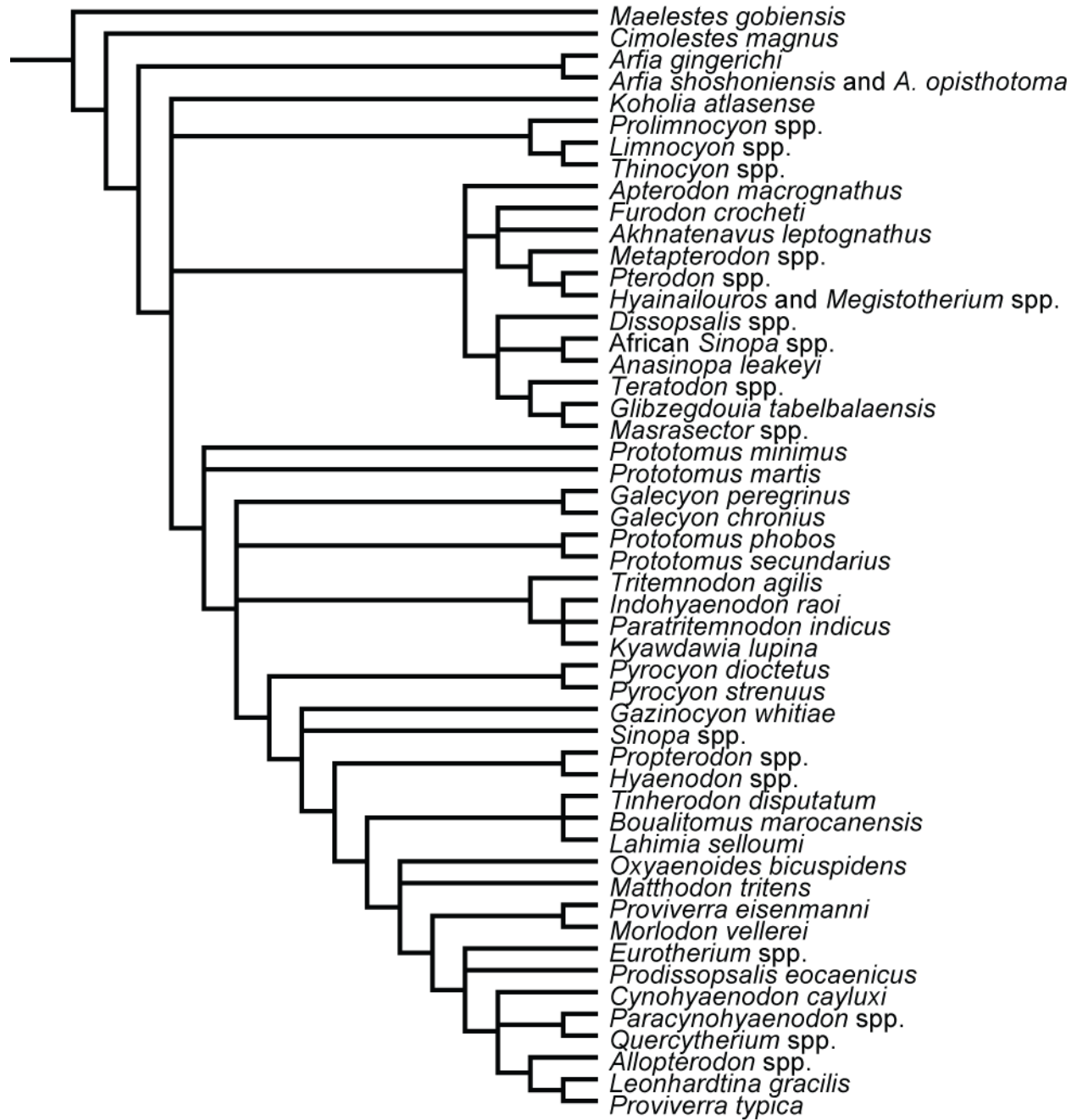


FIGURE S5. Strict consensus of 14 trees (L: 386; CI: 0.29; RI: 0.64) produced by analysis of the character taxon matrix with Sinopaninae constrained to monophyly.

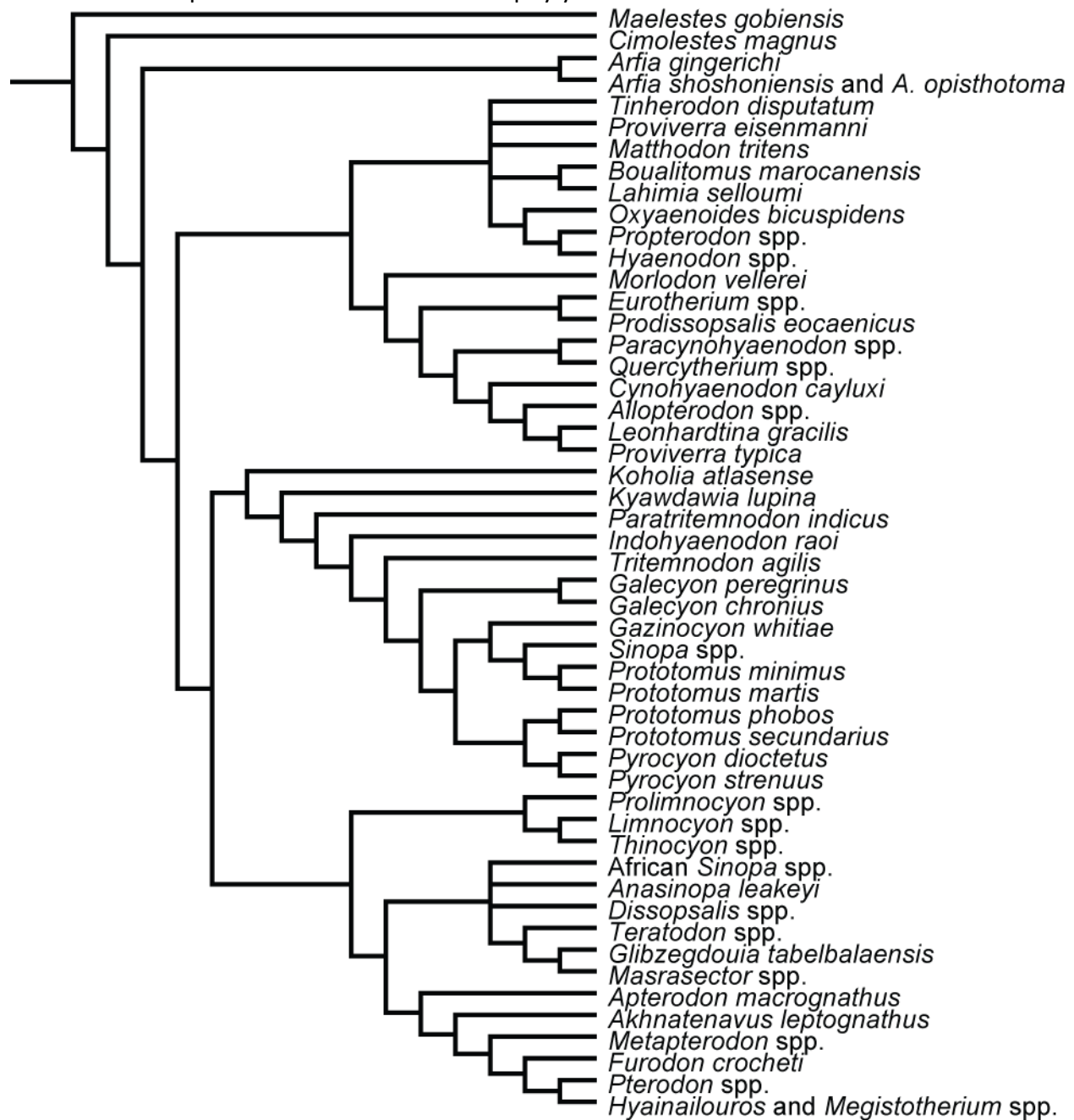


FIGURE S6. Adams consensus of the 14 trees produced by analysis of the character taxon matrix with Sinopaninae constrained to monophyly.

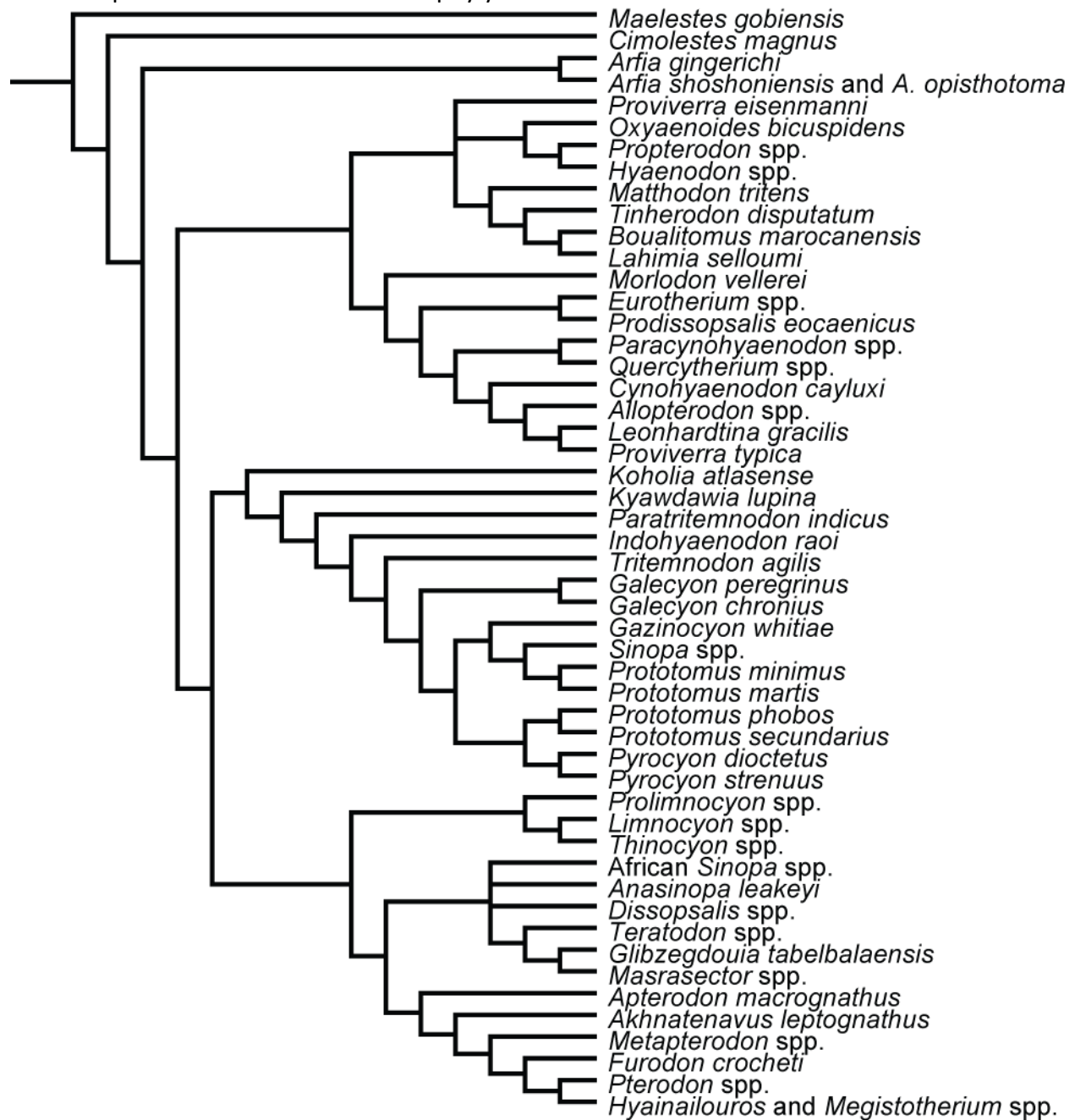


FIGURE S7. Strict consensus of 72 trees (L: 388; CI: 0.29; RI: 0.64) produced by analysis of the character taxon matrix constrained to agree with the results of Grohé et al.'s (2012) analysis.

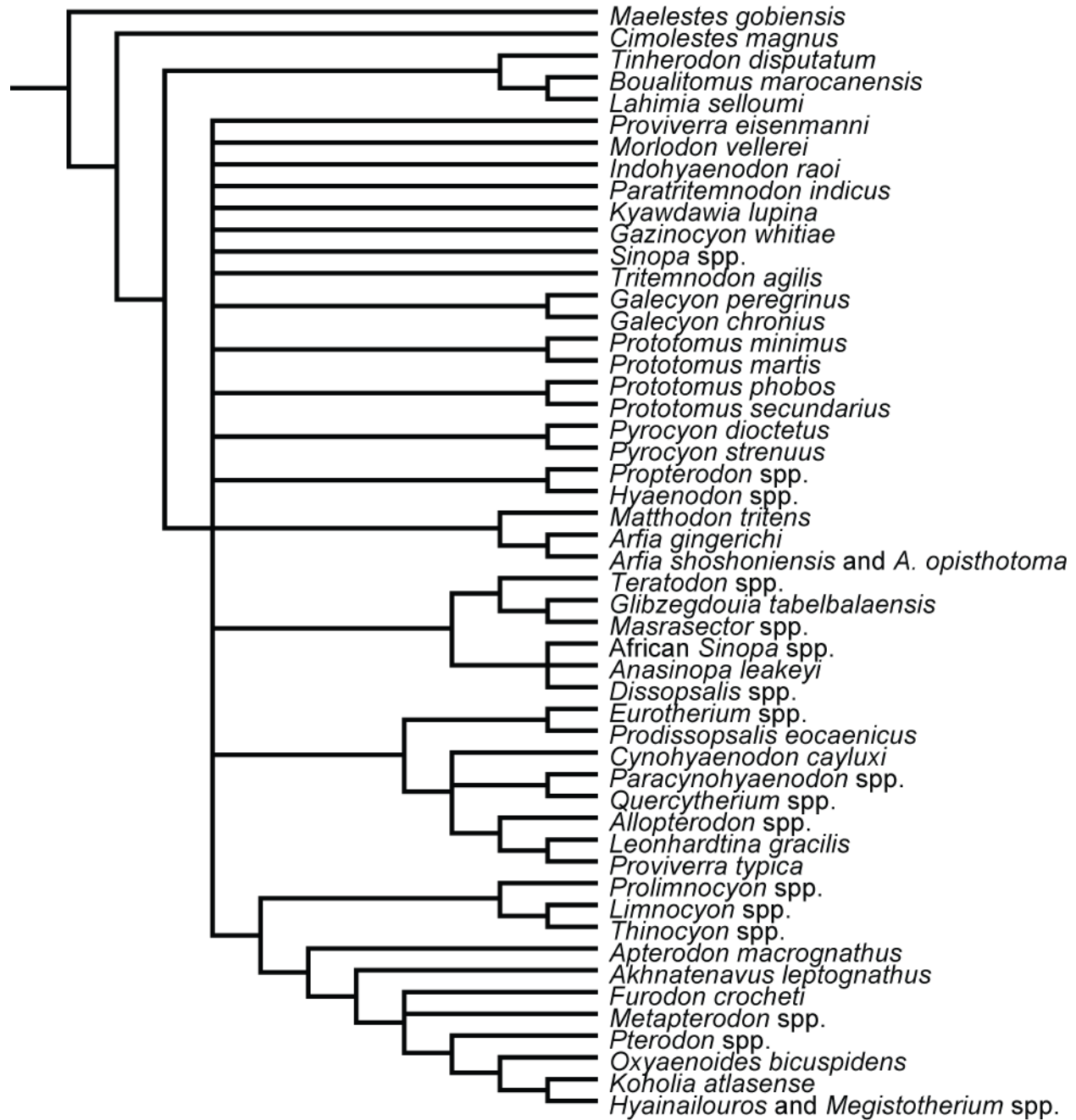


FIGURE S8. Adams consensus of the 72 trees produced by analysis of the character taxon matrix constrained to agree with the results of Grohé et al.'s (2012) analysis.



FIGURE S9. Strict consensus of 213 trees (L: 392; CI: 0.29; RI: 0.64) produced by analysis of the character taxon matrix constrained to agree with the results of Zack's (2011) analysis.

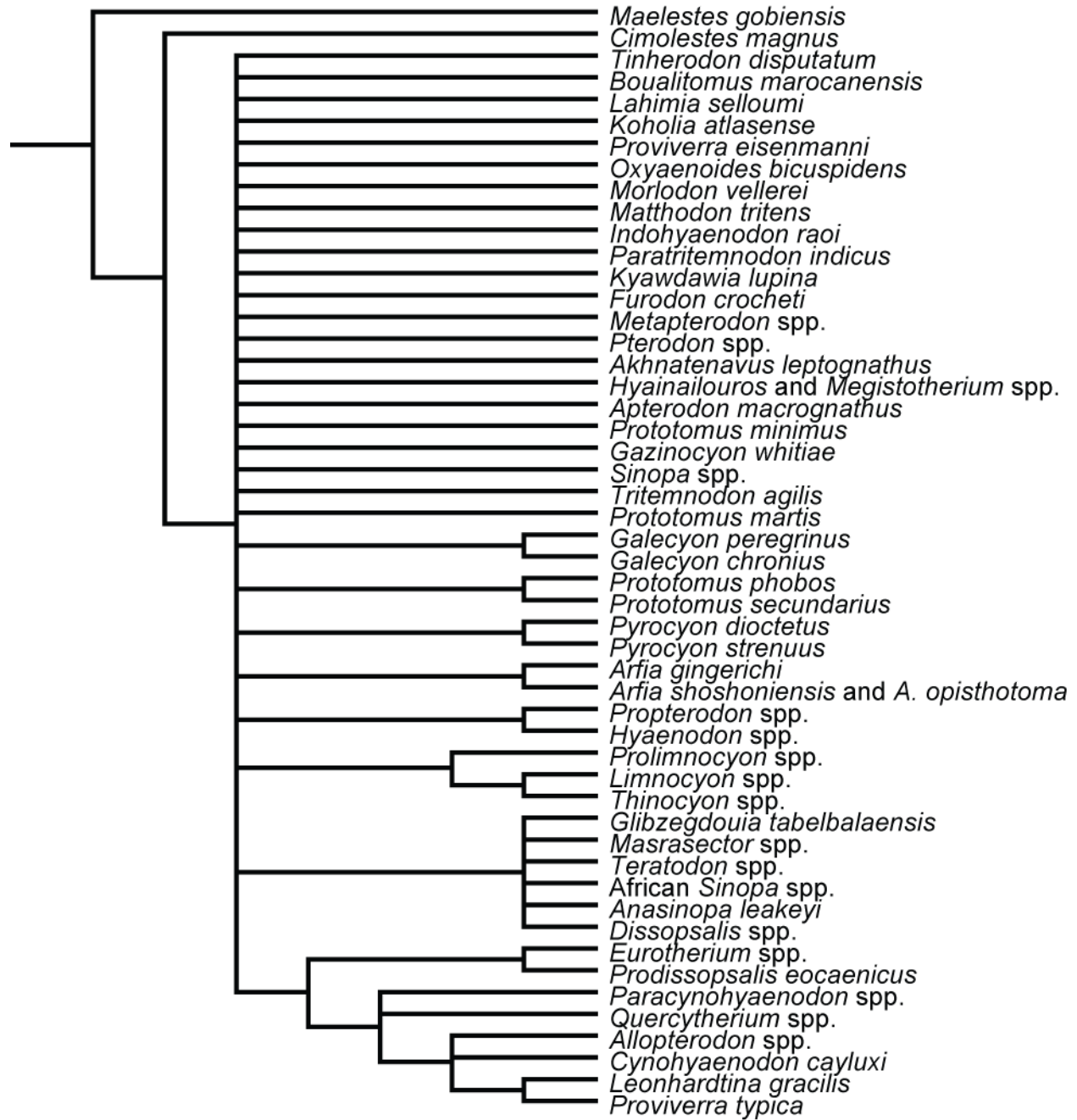


FIGURE S10. Adams consensus of the 213 trees produced by analysis of the character taxon matrix constrained to agree with the results of Zack's (2011) analysis.

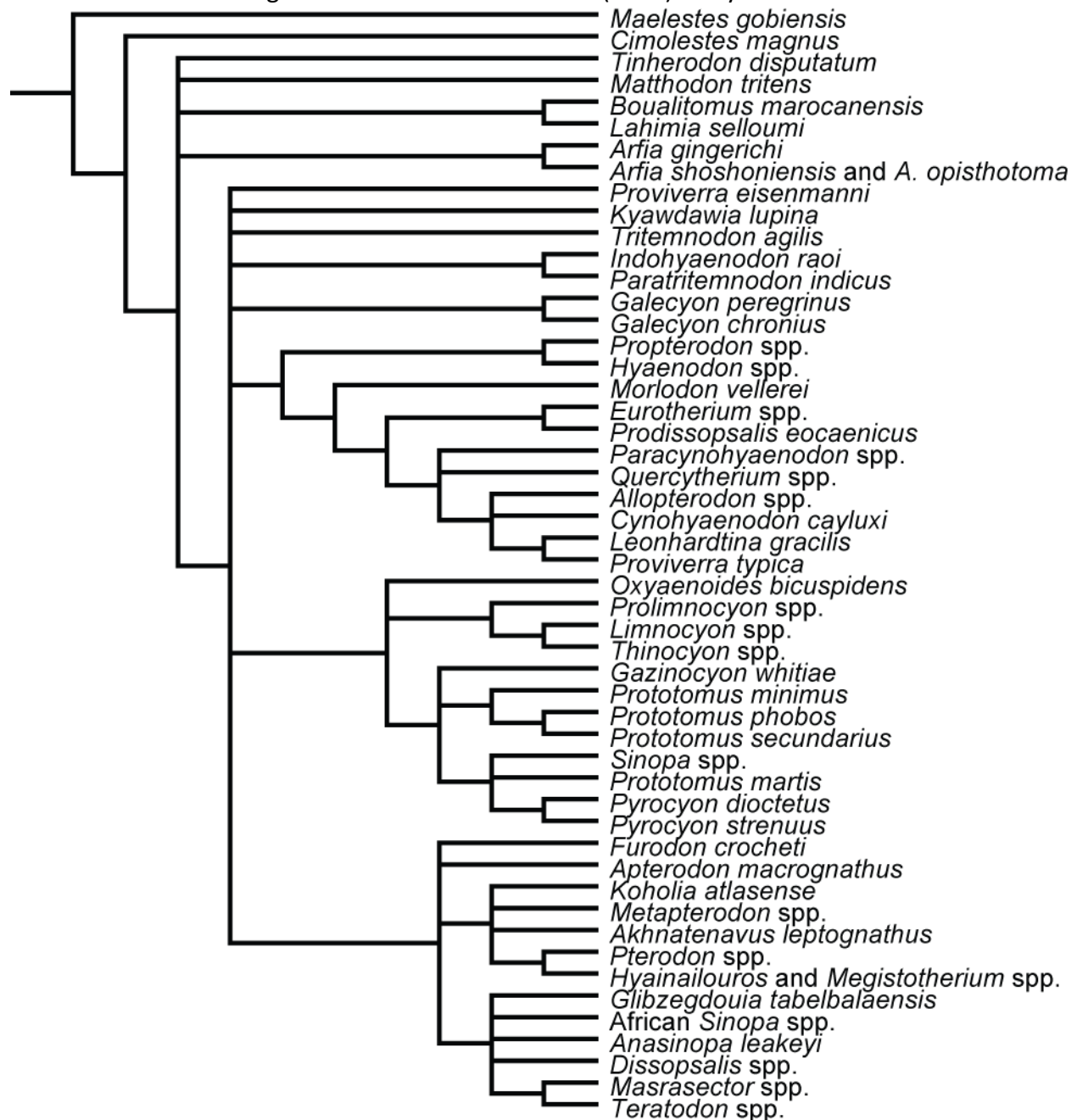


FIGURE S11. Strict consensus of 131 trees (L: 396; CI: 0.28; RI: 0.63) produced by analysis of the character taxon matrix constrained to agree with the results of Polly's (1996) analysis.

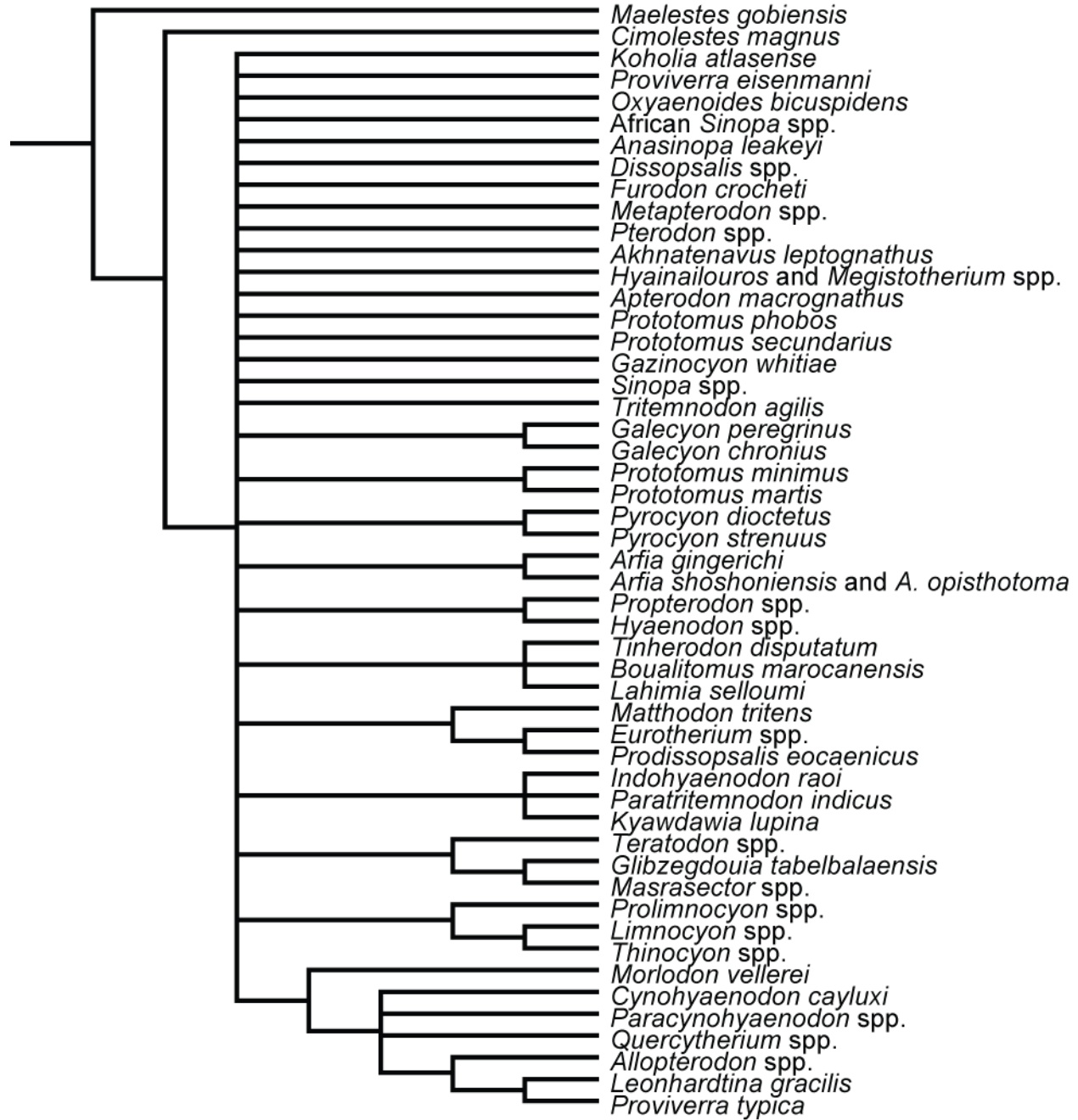


FIGURE S12. Adams consensus of the 131 trees produced by analysis of the character taxon matrix constrained to agree with the results of Polly's (1996) analysis.



FIGURE S13. Strict consensus of 73 trees (L: 404; CI: 0.28; RI: 0.62) produced by analysis of the character taxon matrix constrained to agree with Morlo et al.'s (2014) assessment of hyaenodontid phylogeny.

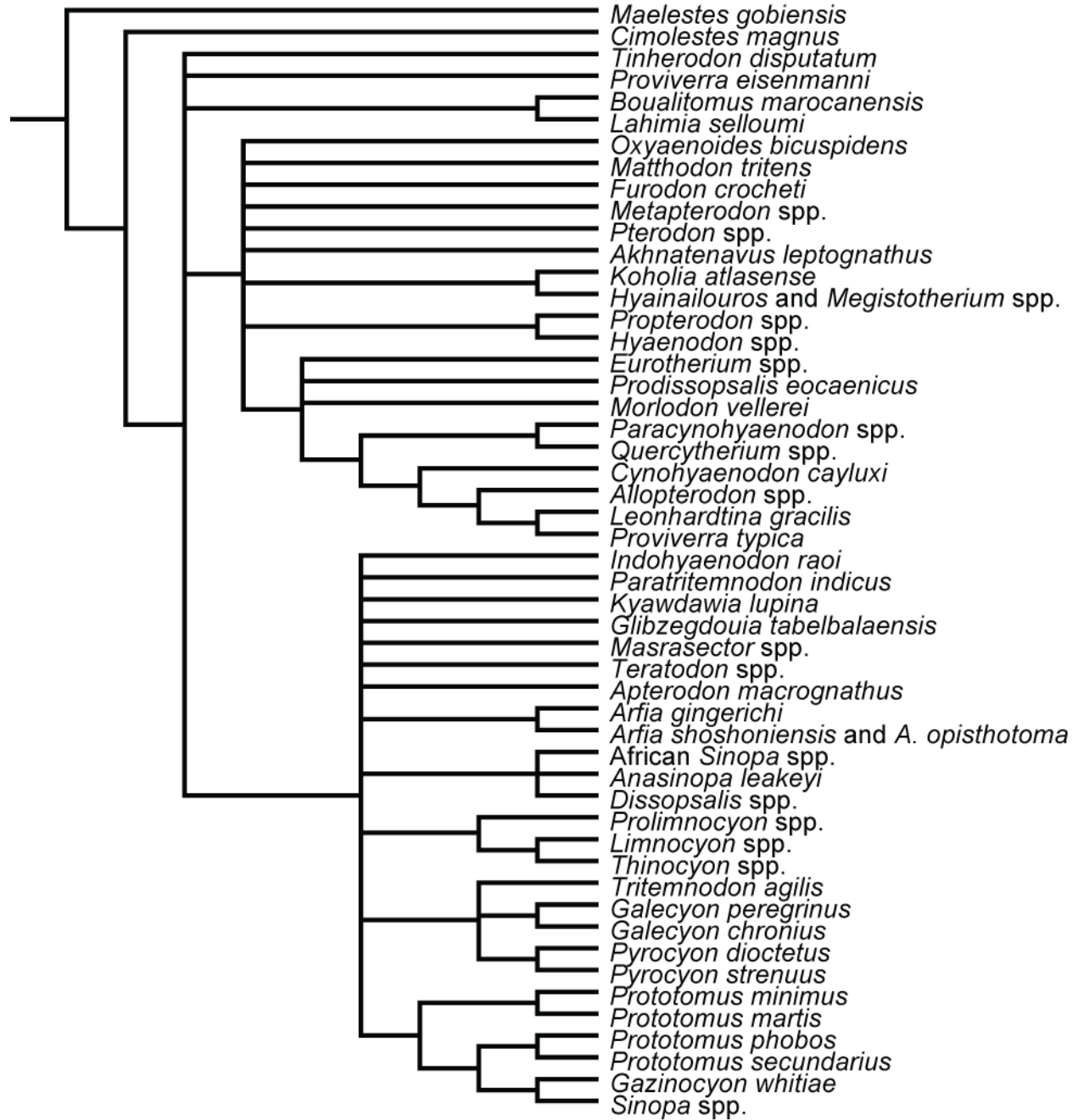


FIGURE S14. Adams consensus of the 73 trees produced by analysis of the character taxon matrix constrained to agree with Morlo et al.'s (2014) assessment of hyaenodontid phylogeny.



FIGURE S15. Strict consensus of 308 trees (L: 412; CI: 0.27; RI: 0.61) produced by analysis of the character taxon matrix constrained to agree with the results of Egi et al.'s (2005) analysis.

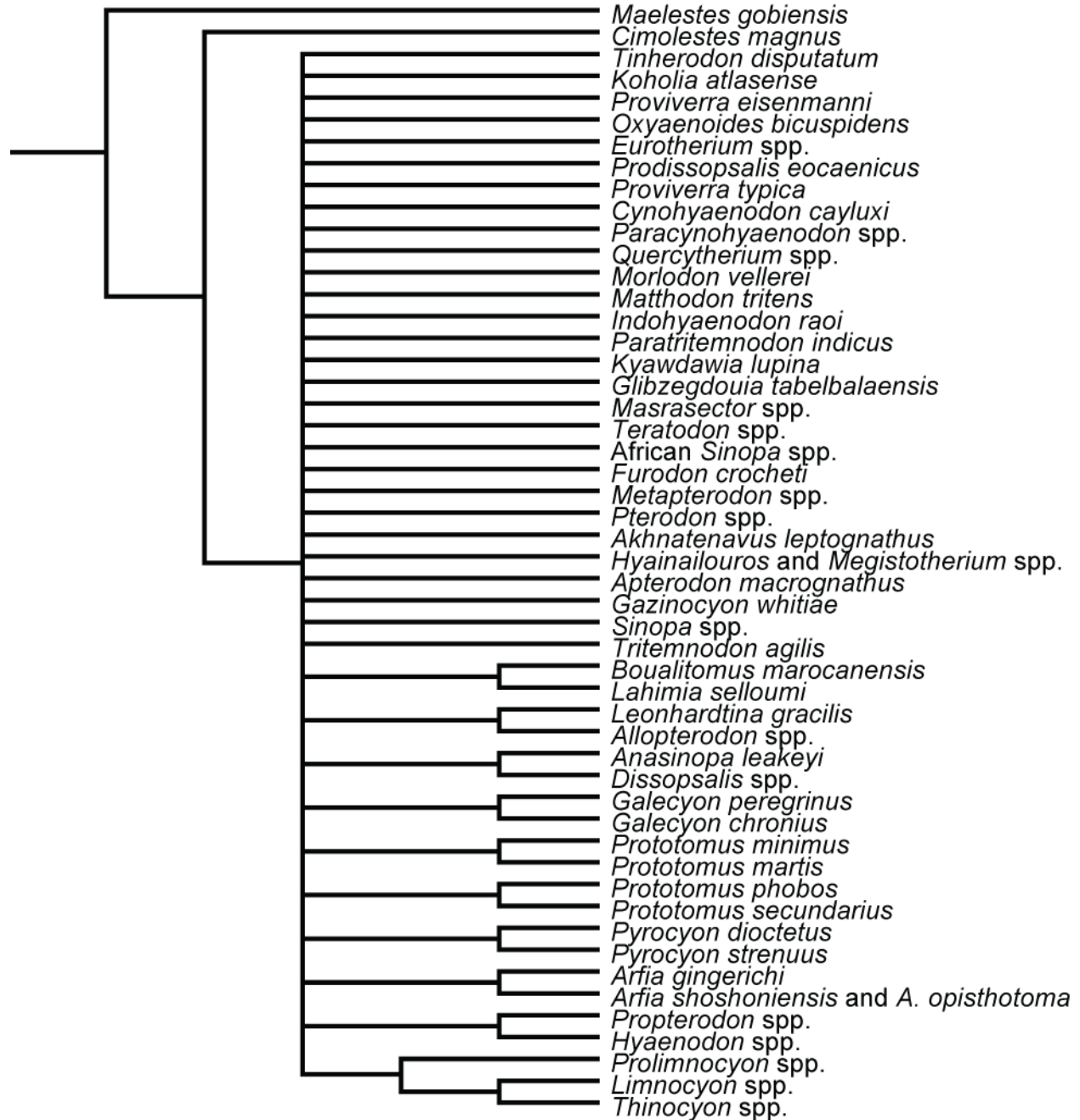
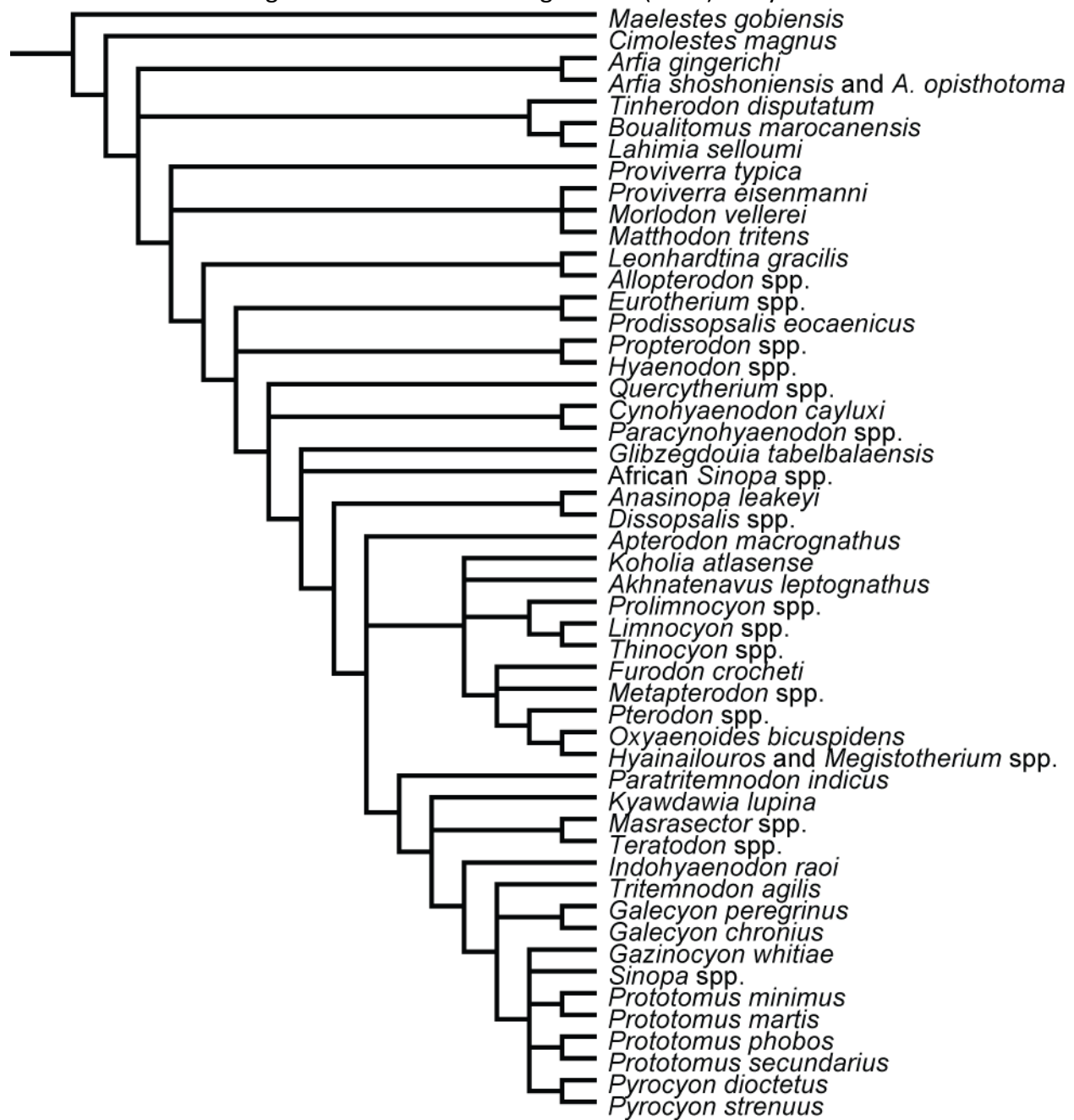


FIGURE S16. Adams consensus of the 308 trees produced by analysis of the character taxon matrix constrained to agree with the results of Egi et al.'s (2005) analysis.



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