

Tapiridae Characters and Character States

In the PAUP analyses, the following multistate characters were treated as ordered: 7, 19, 26, 27, 37, 48, 49, 50, 51, 52, 53, 55, 67.

1. adult height of sagittal crest. (0) moderate; (1) low, less than 2 mm; (2) very high, more than 10 mm.
2. when during ontogeny do temporal crests meet to form a sagittal crest: (0) young juvenile (before eruption of M1); (1) older juvenile (after eruption of M1, before eruption of M2); (2) subadult (after eruption of M2, before loss of DP4); (3) young adult (after eruption of P4 and M3); (4) prime adult (M3 with moderate wear); (5) never.
3. where temporal crests meet to form the sagittal crest: (0) very near the frontal-parietal suture; (1) well anterior to the frontal-parietal suture.
4. dorsal table of frontal. (0) relatively narrow or small; (1) relatively broad.
5. frontal inflation: (0) weak or absent; (1) frontal very strongly inflated.
6. nasal-frontal lateral profile: (0) nasals and frontal approximately on same plane; (1) nasals notably stepped down from frontals.
7. size of interparietal bone: (0) large; (1) small; (2) usually absent in postnatal individuals.
8. shape of interparietal bone: (0) typically polygonal (hexagonal or diamond shaped); (1) typically triangular.
9. interparietal fusion with occipital: (0) occurs early in ontogeny (before loss of DP4); (1) occurs late in ontogeny (after eruption of P4).
10. nasal length: (0) long (longer than 1.5 times the width of combined nasals); (1) short (shorter than 1.5 times the width of combined nasals).
11. anterolateral margin of nasal: (0) relatively straight; (1) distinctly concave.
12. posterolateral margin of nasal: (0) relatively flat; (1) curved downward.

13. “descending sigmoid process” of nasal: (0) present; (1) absent.
14. fossa for meatal diverticulum on nasal: (0) shallow and without distinct margins; (1) deep and with distinct margins.
15. fossa for meatal diverticulum on posterior dorsal surface of nasal: (0) not extensive, does not near midline; (1) very extensive, approaches within a few mm of midline.
16. development of fossa for meatal diverticulum on dorsal table of frontal: (0) very limited; (1) broad exposure with distinct posterior margin.
17. supraorbital groove for nasal diverticulum: (0) broad and shallow; (1) narrow and deep.
18. posterodorsal process of maxilla widely exposed dorsal above the orbit, forming base of trough for meatal diverticulum: (0) yes; (1) no.
19. depth of nasal notch: (0) anterior to orbit; (1) dorsal to orbit; (2) posterior to orbit.
20. orientation of lambdoidal crests in adults: (0) mostly posteriorly, little or not outward flair; (1) posterolateral orientation, with notable lateral flair.
21. dorsomedial border of maxilla: (0) sharp border that is mostly directed medially; (1) rounded border that is directed ventromedially; (2) border up-turned and expanded as an extension of dorsal flange.
22. location of infraorbital foramen relative to the cheek teeth: (0) dorsal to P4; (1) dorsal to P3 or P2.
23. location of premaxillary-maxillary suture relative to alveolus of canine (in lateral view): (0) suture located anterior to canine alveolus; (1) suture located in middle of alveolus of canine.
24. anteromedial process of maxilla: (0) absent; (1) present in most individuals.
25. lateral exposure of anteromedial process of maxilla: (0) maxilla well exposed in lateral view dorsal to premaxilla; (1) maxilla covered by premaxilla, not visible in lateral view or barely so.
26. dorsal maxillary flange: (0) absent; (1) slight; (2) extensive.

27. length of posterior process of premaxilla: (0) long, terminates posterior to P1; (1) terminates dorsal to or just in front of P1; (2) ends about midway over C-P1 diastema; (3) very short, terminates well anterior to midway point of diastema.
28. width of maxillary bar between infraorbital foramen and lacrimal: (0) narrow, usually less than 5 mm; (1) wide, more than 5 mm.
29. shape of lacrimal: (0) narrow, much taller than long; (1) broad, about as long as it is high.
30. facial surface of lacrimal: (0) flat or convex; (1) concave.
31. anterior lacrimal process(es): (0) absent or very weak; (1) present, well developed.
32. posterior (preorbital) process of lacrimal: (0) absent; (1) present.
33. posterior process of lacrimal: (0) broad and flat; (1) slender, pointed or knobby.
34. typical number of lacrimal foramen: (0) two; (1) one.
35. lacrimal foramen visible in lateral view: (0) yes, at least one; (1) no, not visible in lateral view.
36. incisive foramen: (0) terminates posteriorly about midway between canine and P1; (1) terminates posteriorly at P1 or further.
37. relative diastema length: (0) short ($ldl/p2m3L < 0.40$); (1) medium ($0.40 \leq ldl/p2m3L < 0.50$); (2) long ($ldl/p2m3L \geq 0.50$). [ldl = lower diastema length; $p2m3L$ = length from anterior point of p2 to posterior point of m3]
38. relative location of mental foramen: (0) anterior to the p2; (1) directly ventral to the p2.
39. orientation of anterior margin of ascending ramus of mandible in lateral view: (0) projects vertically and posteriorly, not anteriorly (does not overlie the m3); (1) projects anteriorly as well as vertically below the coronoid process, often lies dorsal to m3.
40. depth of horizontal ramus below m3: (0) shallow; (1) deep.
41. relative crown height of cheek teeth: (0) short, relatively brachydont; (1) taller.

42. morphology and size of I3: (0) I3 incisiform, about same size as I2; (1) I3 caniniform, much larger than I2. [equivalent to Colbert (2005) character #3]
43. P1 with: (0) single, small posterolingual cusp (=hypocone of some) and lingual cingulum, but no cross lochs or other cusps; (1) large posterolingual cusp, sometimes with accessory cusps and often with some development of a transverse loph; (2) large posterolingual cusp with strong, complete transverse loph; (3) no distinct posteriorlingual cusp, only a cingulum.
44. P1 TW/L ratio: (0) on average, less than or equal to 0.80; (1) on average, greater than 0.80.
45. P2 ATW/PTW ratio: (0) on average, less than or equal to 0.85; (1) on average, greater than 0.85.
46. P2 lingual cingulum: (0) complete; (1) absent or "broken". [Colbert (2005) #29]
47. transverse lochs on P2-P4 and p2-p4: (0) poorly separated; 1; well separated.
48. P2 protoloph: (0) does not reach ectoloph; (1) just reaches to base of ectoloph; (2) merges midway or higher onto ectoloph.
49. P3 protoloph: (0) does not reach ectoloph; (1) just reaches to base of ectoloph; (2) merges midway or higher onto ectoloph.
50. P4 protoloph: (0) does not reach ectoloph; (1) just reaches to base of ectoloph; (2) merges midway or higher onto ectoloph.
51. P2 metaloph: (0) does not reach ectoloph; (1) just reaches to base of ectoloph; (2) merges midway or higher onto ectoloph.
52. P3 metaloph: (0) does not reach ectoloph; (1) just reaches to base of ectoloph; (2) merges midway or higher onto ectoloph.
53. P4 metaloph: (0) does not reach ectoloph; (1) just reaches to base of ectoloph; (2) merges midway or higher onto ectoloph.
54. P3 and P4 protocone and hypocone: (0) closely oppressed and merge with wear; (1) widely separated.
55. parastyle development on P3-M3: (0) moderate; (1) strong; (2) very strong.

56. labial cingulum on posterior half of upper cheek teeth: (0) present on half or more of P3-M3; (1) absent or very rare on P3-M3.
57. where M1 metaloph joins the ectoloph: (0) near middle of tooth, well in front of metacone; (1) at or near metacone. [modified from Colbert (2005) #18]
58. where M2 metaloph joins the ectoloph: (0) near middle of tooth, well in front of metacone; (1) at or near metacone. [modified from Colbert (2005) #19]
59. where M3 metaloph joins the ectoloph: (0) near middle of tooth, well in front of metacone; (1) at or near metacone. [modified from Colbert (2005) #20]
60. M3 metaloph direction relative to ectoloph: (0) directly primarily linguolabially, forms obtuse angle with ectoloph; (1) runs mesolabially-distolingually, forms acute angle with ectoloph. [Colbert (2005) #21]
61. M2 parastyle: (0) well separated from paracone; (1) compressed against paracone, curving around its labial face. [Colbert (2005) #12]
62. M3 parastyle: (0) well separated from paracone; (1) compressed against paracone, curving around its labial face. [Colbert (2005) #13]
63. M1 ectoloph long axis: (0) essentially straight, joining vertically implanted or slightly distally tilted paracone; (1) labially convex, making U-shaped loph together with protoloph and metaloph; paracone with slight mesial tilt. [Colbert (2005) #14]
64. M2 ectoloph long axis: (0) essentially straight, joining vertically implanted or slightly distally tilted paracone; (1) labially convex, making U-shaped loph together with protoloph and metaloph; paracone with slight mesial tilt. [Colbert (2005) #15]
65. M3 ectoloph long axis: (0) essentially straight, joining vertically implanted or slightly distally tilted paracone; (1) labially convex, making U-shaped loph together with protoloph and metaloph; paracone with slight mesial tilt. [Colbert (2005) #16]

66. Upper and lower molars: (0) without accessory crochets and cristids; (1) with accessory crochets and cristids. [Albright 1998]
67. i1 morphology and size: (0) i1 slightly larger than i2, not procumbent; (1) i1 larger than i2, slightly procumbent; (2) i1 much larger than i2, very procumbent and spatulate.
68. i3 size: (0) i3 as large or only slightly smaller than i2; (1) i3 less than half the size of i2.
69. length of p2 relative to p3: (0) short, $(p2 L)/(p3 L)$ less than 1.1; (1) long, this ratio greater than 1.1.
70. p2 hypoconid and entoconid: (0) not joined by complete hypolophid; (1) connected by hypolophid.
71. p3 and p4 hypolophid: (0) absent; (1) present.
72. relative height of unworn protolophid and hypolophid (or hypoconid/entoconid if no hypolophid) on premolars: (0) protolophid distinctly taller than hypolophid; (1) the two are approximately equal in height.
73. cristid obliqua on p3: (0) strong, blocks interlophid valley labially; (1) very weak or absent.
74. cristid obliqua on p4: (0) strong, blocks interlophid valley labially; (1) very weak or absent.
75. p3 ATW/PTW ratio: (0) on average greater than or equal to one; (1) on average less than one.
[modified from Colbert (2005) #52]
76. p4 ATW/PTW ratio: (0) on average greater than or equal to one; (1) on average less than one.
[modified from Colbert (2005) #52]
77. m3 hypoconulid: (0) present as distinct cusp; (1) absent or present as only a small cusped cingulum.
[modified from Colbert (2005) #40]
78. relatively long limbs (quantified by comparison of the length of the femur and dentary): (0) relatively long limbs (femur greatest length longer than that of dentary); (1) relatively short limbs (femur length less than or equal to that of dentary).
79. articulation between MT1 and MT4 (Radinsky, 1963): (0) no articulation between MT1 and MT4; (1) articular facet present on posterior surface of MT4 for articulation with MT1.

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