Description of an abnormal skull of *Caluromys philander* (Didelphidae: Caluromyinae)

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Abstract: An abnormal skull of *Caluromys philander* (Didelphidae: Caluromyinae) is described. UFMG 4232 is an adult specimen, based on the dental eruption pattern, and was examined and compared with six adult normal specimens of *C. philander.* The specimen has a shortening and right lateral curvature of the rostrum. There is no tooth agenesis, and dental occlusion is, for the most part, preserved. The posterior portion of the skull was not affected. The reported deformities appear to be congenital, and represent one of the few reports of this kind of pathology in Didelphidae.

Key-Words: Deformity; Marsupial; Osteology.

Resumo: Descrição de deformidade craniana em *Caluromys philander* (Didelphidae: Caluromyinae). É relatado um crânio anômalo de *Caluromys philander* (Didelphidae: Caluromyinae). UFMG 4232 é um espécime adulto, baseado no padrão de erupção dentária, e foi examinado e comparado a seis indivíduos adultos normais de *C. philander.* O espécime apresenta o rostro encurtado e curvado lateralmente para a direita. Não há agenesia dentária e a oclusão é em grande parte mantida. A porção posterior do crânio não foi afetada. As deformidades relatadas parecem ser congênitas, e constituem um dos poucos relatos deste tipo de patologia para Didelphidae.

Palavras-Chave: Deformidade; Marsupial; Osteologia.

INTRODUCTION

Cranial anomalies in wild mammals are reported infrequently (Trail & Tumlison, 1984; Jenks *et al.,* 1986; Sone *et al.,* 2004), and very few data are available on its occurrence in Neotropical species. It is expected the prevalence of such deformities in the wild to be relatively low, due to the resulting implications for the cranial structure which, in turn could heavily impair the capacity of the organism to apprehend and manipulate food, eventually leading to the death of the individual. However, reports do occasionally appear in the literature, but usually limited in taxonomic and geographic scope.

Caluromys philander (Linnaeus, 1758) (Didelphidae, Caluromyinae) is a widespread South American marsupial (Gardner, 2007; Flores *et al.,* 2010). It is an arboreal, solitary and nocturnal species, feeding on fruit, nectar, invertebrates, and small vertebrates (Gardner, 2007). Despite detailed descriptions of the skull of didelphids, including *C. philander* (Wible, 2003; Flores *et al.,* 2010), reports of cranial abnormalities are rare for marsupials. Herein we report an abnormal skull of *C. philander* (UFMG 4232) deposited at the Coleção de Mamíferos of the Centro de Coleções Taxonômicas of the Universidade Federal de Minas Gerais (CCT-UFMG).

MATERIAL AND METHODS

The specimen UFMG 4232 was collected at the Brumal district of the Santa Bárbara municipality, Minas Gerais, Brazil (19°57'34"S, 43°24'55"W), in April 25, 2009. UFMG 4232 was examined directly and under a stereoscopic microscope, and compared with six adult normal specimens of *C. philander* deposited at the CCT-UFMG (UFMG 1159, 3782, 3850, 4102, 4103 and 4224). Fourteen linear measurements were taken of all skulls with a caliper with scale resolution of 0.05 mm, based on those proposed by Flores *et al.* (2010): Total Length of The Skull (LT), Length of Palate (PAL), Breadth of Palate (BP), Length of Upper Postcanine Row (UP), Length of Nasals (LN), Zygomatic Breadth (BZ), Breadth of Braincase (BB), Length of Orbit (LO), Height of Muzzle (HM), Height of Occipital Plate (HO), Length of Mandible (LD), Length of Lower Postcanine Row (LP), Height of Mandibular Body (HD), Length of Coronoid Process (LC). All cranial alterations were described, recorded and compared with the condition found in normal specimens.

RESULTS

When compared to normal specimens of *C. philander,* UFMG 4232 show, in dorsal view, a shortening and

Table 1: Cranial measurements (from Flores *et al.,* 2010) of 6 normal adult individuals of *Caluromys philander* analyzed in the present work, plus the abnormal specimen (UFMG 4232) described in the manuscript. LT: Total length of the skull, PAL: Length of palate, BP: Breadth of palate, UP: Length of upper postcanine row, LN: Length of nasals, BZ: Zygomatic breadth, BB: Breadth of braincase, LO: Length of orbit, HM: Height of muzzle, HO: Height of occipital plate, LD: Length of mandible, LP: Length of postcanine row, HD: Height of mandibular body, LC: Length of coronoid process. All measurements in mm.

	UFMG 4232	UFMG 4103	UFMG 4102	UFMG 3782	UFMG 4224	UFMG 3850	UFMG 1159
LT	41.90	47.17	52.18	46.24	48.30	45.57	48.90
PAL	20.92	25.30	27.83	25.65	26.12	25.59	26.41
BP	11.40	12.93	13.43	12.25	12.43	11.16	12.60
UP	12.86	17.16	17.35	15.23	15.10	13.94	15.42
LN	18.71	18.54	21.85	20.16	20.61	19.86	21.12
BZ	27.79	27.18	30.44	27.10	28.58	27.30	29.46
BB	16.91	16.18	17.34	18.89	18.30	18.10	19.78
LO	9.69	10.72	11.96	10.35	11.48	10.54	11.05
HM	5.76	6.58	7.21	7.37	7.54	7.03	7.55
HO	11.80	10.82	12.17	9.69	10.81	9.72	9.90
LD	29.47	35.21	39.02	33.02	35.29	33.12	35.75
LP	15.81	17.17	17.96	16.42	16.34	15.20	17.16
HD	5.49	5.74	7.38	5.97	5.90	5.34	6.17
LC	5.75	5.67	6.00	7.09	7.75	6.87	7.87

right lateral curvature of the rostrum, although the neural portion of the braincase does not show significant alterations (Figure 1). This shortening and twisting of the skull is responsible for the shorter length of the rostral measurements, and less overall length of the skull when compared to most normal individuals (Table 1), although the low number of individuals examined preclude more definitive conclusions. The right lateral curvature of the rostrum is provided largely by the extreme curvature of the right nasal, premaxilla, maxilla, and lacrimal. On the left side, these bones are, in general, wider than on the right. Despite the twisting of the rostrum, the distal tips

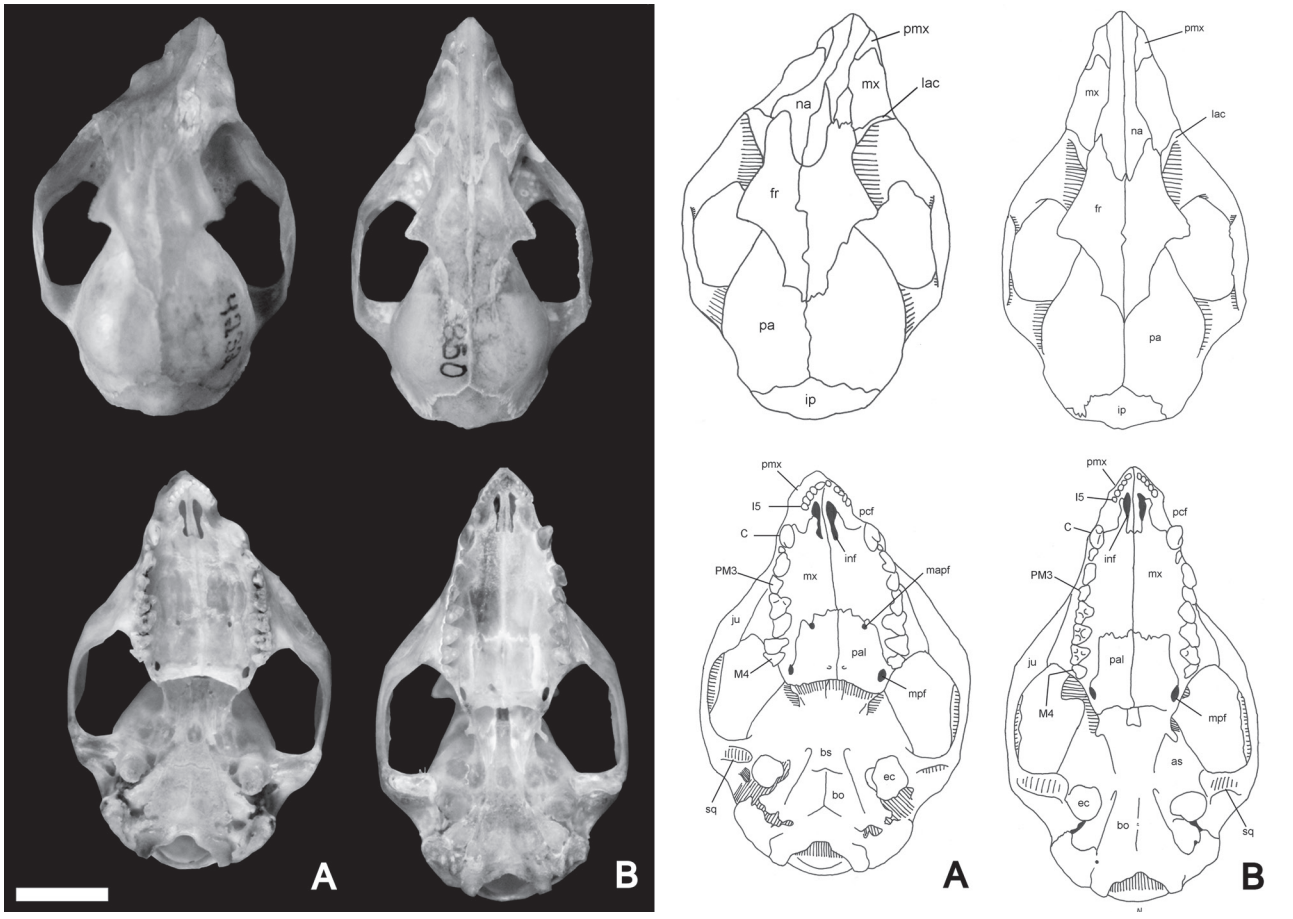

Figure 1: A. The abnormal specimen of *Caluromys philander* described in the manuscript (UFMG 4232) compared with B. a normal specimen (UFMG 3850) in dorsal (upper) and occlusal (lower) views. Abbreviations: as, alisphenoid; bs, basisphenoid; bo, basioccipital C, upper canine; ec, ectotympanic; fr, frontal; I5 fifth upper incisive; inf, incisive foramen; ip, interparietal; ju, jugal; lac, lacrimal; M4, fourth upper molar; mpf, major palatine foramen; mpf, minor palatine foramen; mx, maxilla; na, nasal; pa, parietal; pal, palatine; pcf, paracanine fossa; PM3, third upper premolar; pmx, premaxilla; sq, squamosal. Scale bar = 1 cm.

of the nasals still project forward over the nasal aperture, aligned with the central axis of the skull as in normal specimens (Figure 1). There is an elevated crest on the proximal third of the right nasal, which may indicate a healed fracture. The nasofrontal suture of the right nasal is also more extensive than in its left counterpart. The nasofrontal and nasomaxillar sutures of UFMG 4232 show a more rounded profile, in contrast with the angular profile typical of normal specimens. The interorbital constriction of UFMG 4232 is wider than in normal specimens, in part due to the swelling of the contact region between the nasals, maxillae, and frontals. The left maxilla is depressed in lateral view. The posterior margins of the incisive foramina are displaced posteriorly, at the level of the posterior margin of the canines, when compared with normal specimens. The right lacrimal is reduced, and the anterior margin of the right orbit is broader and more curved. There are small protrusions leaning over the lacrimal foramina on both sides, absent in normal individuals. The shortening of the rostrum occurs concurrently with a widening of the anterior base of the zygomatic arc and an enlargement of the infraorbital foramen (Figure 2). Despite the rostral shortening, there is no tooth agenesis, and all the teeth appear

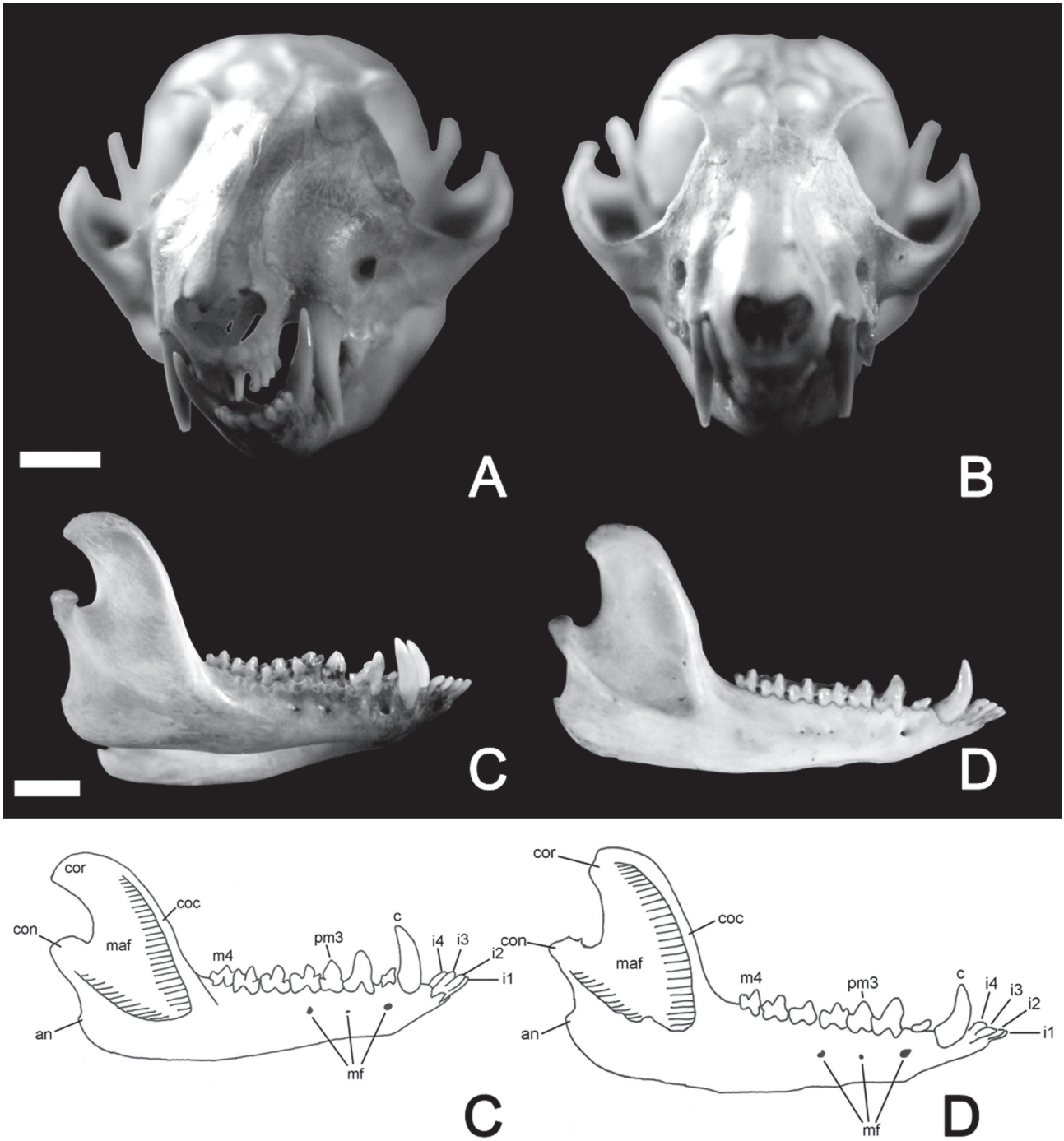

Figure 2: A, C. The abnormal specimen of *Caluromys philander* described in the manuscript (UFMG 4232) compared with B, D. a normal specimen (UFMG 3850) in frontal view with the mandible articulated (A, B), and the right dentary in lateral view (C, D). Abbreviations: an, angular process; c, lower canine; coc, coronoid crest; con, mandibular condyle; cor, coronoid process; i1, first lower incisive; i2, second lower incisive; i3, third lower incisive; i4, fourth lower incisive; m4, fourth lower molar; maf, masseteric fossa; mf, mental foramen; pm3, third lower premolar. Scale bar = 0.5 cm.

morphologically normal, although placed very close to each other. There is a reduction of width of the diastema between the incisors and the canines, and also no space between the canines and the first premolar and between the first and second premolars. The right alveolar line presents an outward curvature in ventral view, and the palate appears shorter and wider than in normal specimens. The right palatine and maxilla also seems to be wider than the corresponding bones on the left side.

The right dentary is shorter than the left and with compressed incisors in occlusal view. The first and second right lower molars are inclined distoproximally, partially overlaying the first molar and third premolar (Figure 2). The lower left dentition does not differ in terms of alveolar alignment from normal individuals. The crest of the masseteric line has a more abrupt curvature than in normal specimens. UFMG 4232 also has inferior prognathism. Despite all these abnormalities, the temporomandibular articulation was not altered and dental occlusion was, for the most part, preserved (Figure 2). The only alterations are on the occlusion between the upper canines and the upper incisors with the lower diastema. In normal individuals, the upper canines fit in the diastema between the lower canine and the first lower premolar. In UFMG 4232, the upper right canine occludes over the second and third lower premolars, while the upper left canine occludes over the first and second lower premolars.

DISCUSSION

The deformities described here are somewhat similar to those described in a juvenile white-tailed deer (*Odocoileus virginianus*) by Jenks *et al.* (1986), with the exception that, in that case, the dentary was also curved laterally, accompanying the condition of the skull. In the case described by Jenks *et al.* (1986), the deformity inhibited the capacity to suckle normally, which resulted in the death of the individual. This was obviously not the case in the specimen described here, since the deformities did not prevent the individual to survive and reach maturity. Cranial deformities are frequently associated to nutritional deficiencies (particularly calcium and phosphorous), pathologies and congenital anomalies (Jenks *et al.,* 1986), as well external agents as high heavy metals concentrations (Suchentrunk *et al.,* 1992) and radiation (Amarena *et al.,* 1994). We found no evidence of bone resorption, frequently associated to nutritional deficiencies and pathologies (Jenks *et al.,* 1986), which seems to suggest that the deformities described here are congenital. Cases where skulls of wild mammals are reported with anomalies as curvature and twisting of the cranium, and yet the animal reached maturity without visible ill effects, are reported occasionally (Ruprecht, 1965).

Although works describing skull abnormalities in wild mammals do appear occasionally in the literature (*e.g.,* Buchalczyk *et al.,* 1981; Trail & Tumlison, 1984; Jenks *et al.,* 1986; Suchentrunk *et al.,* 1992), these reports are generally uncommon. That is especially the case when Neotropical mammals are concerned, for which these kinds of reports are practically non-existent. Most of these works describe deformities related to injuries (Schistoskey, 1971; Trail & Tumlison, 1984; Sone *et al.,* 2004), which does not seem to be the case here, despite the elevated crest on the nasals of UFMG 4232. The present work represents one of the only reports of this kind of congenital disorder in wild didelphid marsupials, and may provide new information for the understanding of its occurrence.

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