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Short article:

Morphometric differences between *Akodon mollis fulvescens* and *A. m. altorum*

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Philip Hershkovitz (1940) proposed the addition of *Akodon mollis fulvescens*, as a new subspecies separated from *A. m. altorum*. However, the presence of olive coloured fur in both species makes it difficult to distinguish them; therefore, geographical distribution is the main trait used to differentiate them. Based on their typical locality (Hershkovitz, 1940), and sites of collection of the subspecies, populations of the Central Sierra of Ecuador are considered to correspond to *A. m. fulvescens*, while those of the Northwestern Sierra to *A. m. altorum*.

A map of the distribution of five species of Akodontini (Sigmodontinae, Cricetidae) in Ecuador is presented in Moreno & Albuja (2005); it seems that subspecies distribution is influenced by the altitudinal gradient. *A. m. altorum* have been collected in an altitudinal range between 2,700 m (Moreno & Albuja, 2005) and 4,121 m asl (Voss, 2003), while *A. m. fulvescens* have been recorded from 740 m to 2,000 m asl (Moreno & Albuja, 2005).

Mammologist currently recognize that *Akodon mollis* has a very large wide geographical range, since they can withstand substantial geographical variations (Voss, 2003). It is possible that some species or subspecies could be masked in this taxa. Hence, in this short article we present key cranio-dental and postcranial morphological variations of *Akodon mollis* specimens collected in the Central Sierra of Ecuador, which we classified as *A. m. fulvescens* and *A. m. altorum* based on characteristics proposed by Hershkovitz (1940).

Table 1. Mean ± standard error, number of observations (range: minimum value-maximum value) of cranio-dental and postcranial measurements of *Akodon mollis altorum* and *Akodon mollis fulvescens*. Explanations about their methods of measurement are present in Voss (2003) and Gómez-Laverde *et al*. (2004).

	Measurements	**Subespecies**	
		altorum	***fulvescens***
Cranio-dental	CIL (s)	24±0.24, 19 (21.71-25.35)	23.44±0.18, 20 (22.01-25.06)
	ZB (ns)	12.67±0.13, 21 (11.31-13.5)	12.5±0.15, 20 (10.93-13.79)
	LIB (ns)	4.68±0.03, 21 (4.32-4.98)	4.74±0.03, 20 (4.39-4.98)
	LIF (ns)	5.31±0.13, 21 (3.82-6.24)	5.18±0.07, 20 (4.62-5.72)
	BIF (ns)	2.12±0.04, 21 (1.72-2.57)	2.04±0.05, 20 (1.45-2.47)
	LD (ns)	6.95±0.1, 21 (5.74-7.58)	6.85±0.08, 20 (6.27-7.61)
	BPB (s)	3.08±0.06, 21 (2.66-3.69)	2.93±0.04, 20 (2.57-3.38)
	BIT (s)	1.52±0.04, 21 (1.19-1.85)	1.44±0.02, 20 (1.24-1.6)
	LM (ns)	4.01±0.04, 21 (3.66-4.4)	4.05±0.04, 20 (3.78-4.42)
	BM1 (ns)	1.23±0.02, 21 (1-1.37)	1.21±0.02, 20 (1.07-1.32)
	DI (ns)	1.37±0.03, 21 (1.12-1.74)	1.38±0.03, 20 (1.06-1.72)
	BZP (ns)	2.43±0.06, 21 (1.81-2.97)	2.36±0.04, 20 (2.06-2.7)
	CH (ns)	8.25±0.07, 19 (7.85-8.78)	8.19±0.06, 20 (7.69-8.73)
Postcranial	TL (s)	141.17±12.07, 21 (10.6-190)	103.43±15.99, 19 (13.9-180)
	Tail (s)	67.76±1.67, 18 (55-80.7)	62.67±2.08, 12 (46-73)
	HB (ns)	94.77±2.32, 18 (73-111)	92.08±2.17, 12 (75-107)
	FH (ns)	19.14±1.32, 20 (11-39.6)	21.31±1.06, 19 (16.9-33.35)
	Ear (ns)	15.54±0.32, 17 (12.2-17.4)	15.39±0.23, 12 (13.8-16.9)
	W (ns)	29.15±1.5, 17 (13.6-38.07)	26.29±1.78, 12 (15.85-38.07)

CIL= condylo-incisive length, ZB= zygomatic breadth, LIB= least interorbital breadth, LIF = length of one incisive foramem, BIF= breadth across both incisive foramina, LD= length of diastema, BPB= breadth of the palatal bridge, BIT= breadth across both upper incisor tip, LM= occlusal length of the maxillary molar row, BM1= breadth of the first maxillary molar, DI= depth of upper incisor, BZP= breadth of the zygomatic plate, TL= total length, Tail= tail length, HBL= head-body length, HF= hindfoot length, Ear= ear length, W= weight, s= significant with p< 0,05, ns= no significant.

We evaluated 12 cranio-dental [condylo-incisive length (CIL), zygomatic breadth (ZB), least interorbital breadth (LIB), length of one incisive foramem (LIF), breadth across both incisive foramina (BIF), length of diastema (LD), breadth of the palatal bridge (BPB), breadth across both upper incisor tip (BIT), occlusal length of the maxillary molar row (LM), breadth of the first maxillary molar (BM1), depth of upper incisor (DI), breadth of the zygomatic plate (BZP)] and 7 postcranial measurements [total length (TL), tail length (Tail), head-body length (HBL), hindfoot length (HF), ear length (Ear), weight(W)], recommended by Voss (2003) and Gómez-Laverde et al. (2004) in 20 vouchers classified as *A. m. altorum* and 19 as *A.* m. fulvescens; all collected in the "Hacienda El Prado" (2,740 m asl), campus of the Universidad de las Fuerzas Armadas – ESPE, and deposited in the MIZI museum (Museo de Investigaciones Zoológicas del IASA) (Table 1).

Both cranio-dental and postcranial measurements fit the normality assumption, but neither adjusted to the homogeneity of variances. Montecarlo's test (10 000 iterations) was used to build 95 % confidence intervals (Hood, 2010), where we found that TL, Tail, CIL, BIT and BPB exhibit significant differences between subspecies ($p < 0.05$, Figures 1 and 2).

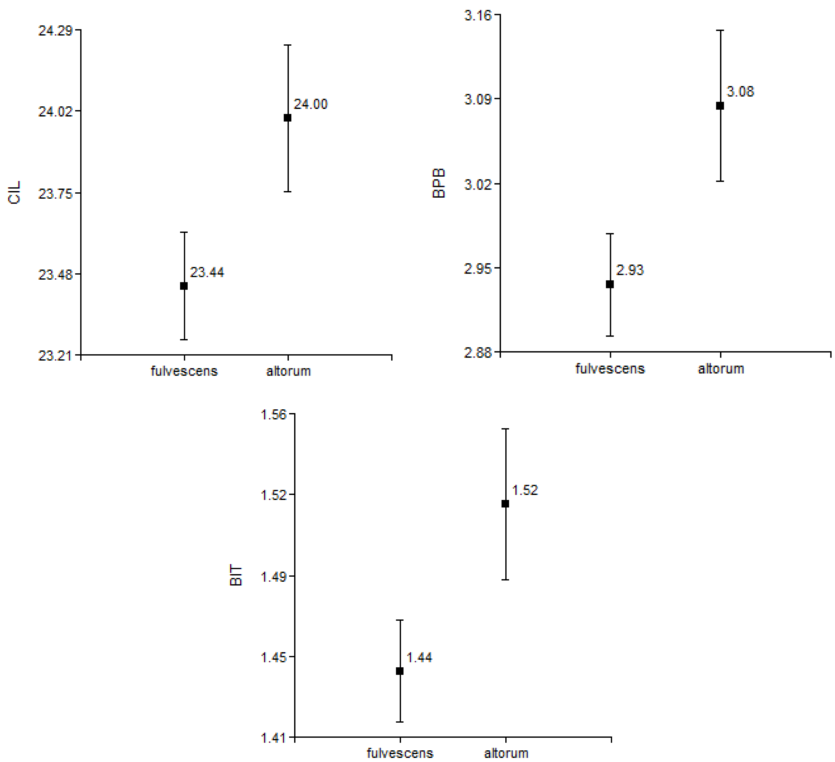

Figure 1. Significant cranio-dental measurements ($p < 0.05$) according to Montecarlo's analysis. Dot diagram represents 95 % confidence intervals.

To get relevant conclusions, the measurements found to be significant according to Montecarlo's analysis, were further tested to non-parametric Kruskal-Wallis ANOVA (Sokal & Rolhf, 2009). These analyses demonstrated that *A. m. fulvescens* TL and CIL were significantly smaller than *A. m. altorum* TL and CIL ($H = 4.35$, $p = 0.036$; $H = 5.05$, $p = 0.025$; respectively).

Most of the literature shows measures of central trends obtained from a small number of samples, which do not allow for consistent statistical analysis. For instance, Moreno and Albuja (2005) introduced a table to easily identify *Akodon* species; however, the statistical range of the measurements could cause confusion if we only used this information, since the measures overlap once error or standard deviation values are included

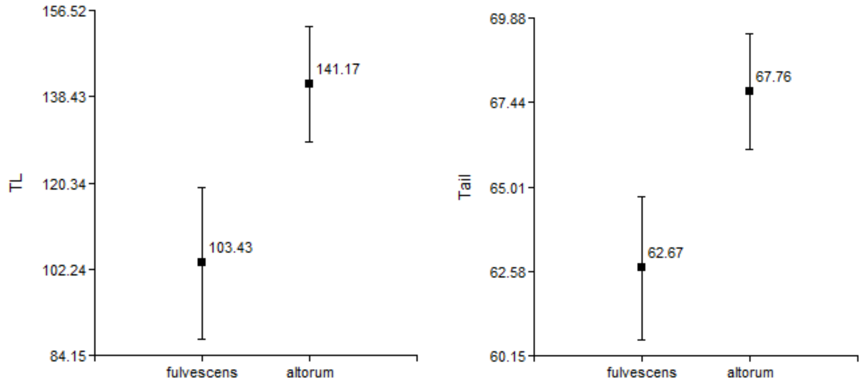

Figure 2. Significant external measurements ($p < 0.05$) according to Montecarlo's analysis. Dot diagram represents 95 % confidence intervals.

Whereas, authors as Gómez-Laverde et al. (2004) and Alvarado-Serrano & D'Elia (2013) rely on genetic studies, as well as statistical analyses applied to morphometric measures to separate taxa from each other. However, not all cranio-dental and postcranial measurements are significant, and they could vary between populations of the same species (Gómez-Laverde et al., 2004: 129-131).

Based on the results of our analyses, which suggest that TL of *A.m. fulvescens* is significantly shorter than TL of *A. m. altorum*, we propose that the postcranial measure to that should be used to differentiate the subspecies of *Akodon mollis* is the length of the tail. Likewise, we found that CIL is significantly greater in *A. m. altorum* than in *A. m. fulvescens*. Therefore, we propose that the cranio-dental measure to be used to distinguish between the subspecies of *Akodon mollis* is the condyle-incisive length (CIL).

Conflicts of interest: The authors declare that there were no conflicts of interest during the development of all the phases involved in the investigation.

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