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Preliminary results on tail energetics in the Moorish gecko, *Tarentola mauritanica*

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Abstract. The amount of lipids, proteins, ashes and water in original versus regenerated tails in *Tarentola mauritanica* shows differences, especially on the lipid fraction, supporting adaptive function hypotheses during reproduction of regenerated tails in geckos.

Keywords. Tail autotomy, energetic components, Moorish gecko, *Tarentola mauritanica*.

The tail in vertebrates has the basic function to help the animal's movement during swimming (e.g. in fish, newts, marine snakes, crocodiles and in marine mammals), during running, jumping and climbing (many lizards and most terrestrial mammals) or flying (birds and bats). In some reptiles, however, especially in lizards, the tail has a double, integrated function: i) balancing during movement and ii) acting as predator escape device. Tail loss may happen during a predation attempt or as a result of intraspecific interactions. In both cases, tail loss could affect many other features of a lizard's ecology and biology, such as locomotory performances (Bateman et al., 2009), the total amount of energetic reserves or courtship ability.

In fact, lizards may lose a substantial amount of lipids and proteins along with the tail loss, and further energies are needed to regenerate the appendage as to previous anatomical and physiological status. In addition to several papers inspecting both the adaptive and functional meaning of tail autotomy (e.g. Perez-Mellado et al., 1997), since more than 40 years analytical data set on tail energetics have been collected on several species of lizards of different families, especially in the gekkonid genera *Coleonyx* and *Hemidactylus*, and in the skinks *Eumeces* and *Ctenotus*. As far as we are aware, no European species has been still considered (see Table 1).

We performed chemical analysis of integer and regenerated tails of the Moorish gecko, *Tarentola mauritanica*, to test for any differences in the content of water, lipids, proteins and ashes between the two tail types. More specifically, we are aimed at underlining

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Table 1. Available data on chemical and energetics in lizard species. "O" means original, "R" regenerated.

Species	Tail	N	Calories	Lipids	Proteins	Ashes	Water
Coleonyx variegatus (Vitt, 1977)	O	3	5.79	34.9	-	9.01 ± 2.06	25.7
	R	19	6.24	24.9	-	6.52 ± 0.67	25.7
Coleonyx brevis (Dial and Fitzpatrick, 1981)	O	8	6.04 ±0.10	.	.	8.21 ± 1.10	71.9 ±1.61
Eumeces gilberti (Vitt, 1977)	O	3	5.12	46.9		15.86 ± 0,48	71.0
	R	14	6.59	58.0		7.69 ± 0.45	52.9
Gerrhonotus multicarinatus (Vitt, 1977)	O	3	5.11	10.5		23.88 ±0.51	71.1
	R	18	6.41	30.3		5.95 ± 0.63	63.6
Podarcis erhardii (Simou et al., 2006)	O	9		33 ± 18	30 ± 5		
	R	14		40 ± 12	28 ±5		
Phyllodactylus marmoratus (Daniels, 1984)	O	7		32.4 ± 8.7			
Hemidactylus mabouia (Meyer, 2002)	O	14			65[1]		
	R	18			50[1]		

[1] mg/g of tissue.

Table 2. Energetic components in *Tarentola mauritanica* tails. All components are expressed as percentage of dry weight, except water (percentage of wet weight), and calories (per mg of dry weight).

	Tail type	
	Original	Regenerated
Proteins	69.23	56.72
Lipids	14.29	27.34
Ashes	13.10	11.65
H_2O	66.0 ± 10.0.4	67.7 ± 8.3
Kcal/g	4.04	5.18

if energetic contents of *Tarentola* tails may be different according to the systematic position and relationship of the reference *taxa*.

We analyzed a total of 31 tails, 16 original and 15 regenerated, equally distributed between adult males (six vs. four), adult females (three vs. five) and juveniles (five vs. three), plus five belonging to adult geckos whose sex was not recognizable. All samples were freshly weighted. Tail fragment autotomized at 2nd or 3rd segment represents on average 9% of total body mass (5.5% in juveniles), disregarding of tail being original or regenerated (t-test on arcsine transformed value = 0.987, 30 df, P = 0.342). Regenerated tails slightly differ in shape, being shorter and bulkier than the original ones, even not significantly (t-test = 0.144, 30 df, P = 0.888), thus resulting in a sort of carrot-shape element.

The subsequent processing follows a procedure recently applied on snakes, described in Zuffi et al. (2010). For the nutrient analysis following water extraction (proteins, fat and ashes), due to the minimum weight analyzable (3.5 grams of dried tails), we had to pool all samples in just two groups: regenerated and original, as in Table 2.

Our analyses show a decreased amount of proteins and ashes in regenerated tails, while the lipid fraction is much higher than in original tails; no difference at all in water content, other than for juveniles (data not shown). The whole pattern resembles that one found in other lizard species and the positive variation of lipids in regenerated tails is in line with several other lizard species, irrespective of their taxonomic position (see Table 1), but is much more pronounced than in the majority of them, especially more than in other geckos. In fact, lipid contents in regenerated tails of *T. mauritanica* is almost double than in original tails. The overall energetic estimation does not differ from the patterns found in other studied *taxa* (see Table 1).

A careful comparison, albeit preliminary, between literature data and present study seems hazardous: data on proteins in most species and families are in fact lacking, and data set is very variable, referring to *taxa* belonging to different taxonomic positions (e.g. Scincidae, Gekkonidae), and showing contrasting life-history traits (e.g. terrestrial vs. arboreal species), that could influence energetic gain patterns. Despite that we are referring to preliminary data, we are confident they should be considered as valuable, due to the evident data scarcity and complete analyses on this topic since the last 20 years.

We furthermore underline the need for a deeper investigation with larger samples, sexual differences in energy allocation processes and the adaptive meaning of these mechanisms, and on multiple species.

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