

A tail where it shouldn't be: a morphological anomaly in *Podarcis erhardii*

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Morphological malformations in animals always attracted interest and stimulated fantasy (Dendle, 2006). In herpetofaunistic studies such cases are much more common among amphibians than reptiles (Gatti and Sannolo, 2014; Martínez-Silvestre et al., 2014; Koleska and Jablonski, 2016). In lizards, morphological anomalies pertain mostly to bifurcated (Kumbar et al., 2011; Tamar et al., 2013) or even trifurcated (Pheasey et al., 2014; Koleska and Jablonski, 2015) regenerated tails. Here we report a case of hindlimb malformation in a lacertid lizard.

On 14 October 2016 we realized a field trip to capture Erhard's wall lizards, *Podarcis erhardii* (Bedriaga, 1882), for an ecophysiological experiment regarding tail regeneration on the Parnitha Mountain at the north-western outskirts of Athens. The habitat (N 38° 10', E 23° 43') is a mild slope located at 1,150 m a.s.l. and is surrounded by higher mountain peaks (up to 1,400 m), vegetated with Greek fir (*Abies cephalonica*) and Aleppo pine (*Pinus halepensis*). The slope was covered with Greek fir till 2007 when a wildfire burnt down the forest. Nowadays, it comprises low fences, made by the half-burnt trunks, which were built to prevent soil erosion. Lizards, that used to be confined in rocky meadows within the once extended fir forest (Pafilis and Simou, 2006), have occupied the area and established dense populations.

Podarcis erhardii is a small-bodied (snout to vent length: 65–103 mm) diurnal lacertid that ranges all over mainland Greece (not common in the Peloponnese though) and in most of the Sporades and Cyclades Islands

(Valakos et al., 2008). Thanks to its wide distribution there is an impressive differentiation within the species and 21 subspecies have been described (Poulakakis et al., 2003; Uetz et al., 2017). It is a mainly insectivorous species that feeds predominantly on coleopterans, orthopterans and arachnidians, but during summer widens its diet including ants and fruits (Valakos et al., 1997; Adamopoulou et al., 1999; Brock et al., 2014). In the given biotope in Parnitha, lizards find easily their food foraging among the trunk fences and stone piles.

The focal individual was a subadult female (SVL: 54 mm). Its general appearance was typical for the species, but the left hindlimb had a strange tail-like extremity (Fig. 1a). At the end of the upper hind thigh, the lower hindlimb and hindfoot were replaced by a short protruding structure. The characteristic segments of the tail were well shaped and clearly obvious. The tip of this structure was similar to that of a tail (Fig. 1b), without any toes and claws. During the time we handled the lizard, the limb was constantly moving in the wavy way tails do.

The formation of this tail-like limb is most probably the product of direct teratogenesis during the embryogenesis. Though lacertids engage in aggressive intraspecific encounters that often end with limb amputation (Vervust et al., 2009; Cooper et al., 2015), regeneration only occurs after a loss of a tail, not a limb, contrary to what is observed in young urodele amphibians (Carlson, 2007).

After the measurements, the lizard was released back in the field. It was a fully functional individual, able to run and climb without a problem. The numerous scars in the ventral side (Fig. 1a), probably resulting from mating attempts of males, suggest that the observed hindlimb peculiarity did not affect its reproductive status, in agreement with previous studies reporting that amputation causes less flaws in the reproductive success of female compared to male lizards (Fox et al.,

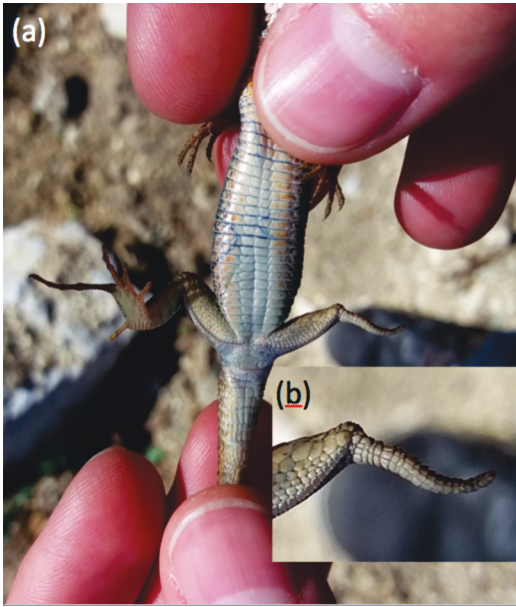


Figure 1. (a) Ventral side of the focal *Podarcis erhardii* female. The malformation is located on the left hindlimb. (b) A close-up view on the malformed hindlimb.

1998). Such reports come to enhance our knowledge on morphological anomalies in lizards and their (possible) consequences to the overall fitness of these animals.

References

- Adamopoulou, C., Pafilis, P., Valakos, E.D. (1999): Diet composition of *Podarcis milensis*, *Podarcis gaigeae* and *Podarcis erhardii* (Sauria: Lacertidae) during summer. *Bonn Zoological Bulletin* **48**: 275-282.
- Brock, K.M., Donihue, C.M., Pafilis, P. (2014): Novel records of frugivory and ovophagy in *Podarcis* lizards from East Mediterranean Islands. *North-Western Journal of Zoology* **10**: 223-225.
- Carlson, B.M. (2007): *Principles of Regenerative Biology*, p. 400. Elsevier Inc.
- Cooper, W.E., Dimopoulos, I., Pafilis, P. (2015): Sex, age, and population density affect aggressive behaviors in island lizards promoting cannibalism. *Ethology* **121**: 260-269.
- Dendle, P. (2006): Cryptozoology in the Medieval and Modern Worlds. *Folklore* **117**: 190-206.
- Fox, S.F., Conder, J.M., Smith, A.E. (1998): Sexual dimorphism in the ease of tail autotomy: *Uta stansburiana* with and without previous tail loss. *Copeia* **1998**(2): 376-382.
- Gatti, F., Sannolo, M. (2014): Two cases of polydactyly in the Italian crested newt, *Triturus carnifex*. *Herpetology Notes* **7**: 477-478.
- Koleska, D., Jablonski, D. (2015): Tail trifurcation recorded in *Algyroides nigropunctatus* (Duméril & Bibron, 1839). *Ecologica Montenegrina* **3**: 26-28.
- Koleska, D., Jablonski, D. (2016): Two cases of unclear hindlimb malformation in *Bombina variegata*. *Ecologica Montenegrina* **9**: 56-58.
- Kumbar, S.M., Ghadage, A.B., Shendage, V.M. (2011): *Hemidactylus flaviviridis* (House Gecko). Bifurcation. *Herpetological Review* **42**(1): 94.
- Martínez-Silvestre, A., Amat, F., Carranza, S. (2014): Natural incidence of body abnormalities in the Montseny newt, *Calotriton arnoldi* Carranza and Amat, 2005. *Herpetology Notes* **7**: 277-279.
- Pafilis, P., Simou, C. (2006): The southernmost geographic distribution of *Podarcis erhardii*. *Herpetological Review* **37**(2): 361-362.
- Pheseay, H., Smith, P., Brouard, J.P., Atkinson, K. (2014): *Vanzosaura rubricauda* (Red-tailed Vanzosaur). Bifurcation and trifurcation. *Herpetological Review* **45**(1): 138-139.
- Poulakakis, N., Lymberakis, P., Antoniou, A., Chalkia, D., Zouros, E., Mylonas, M., Valakos, E.D. (2003): Molecular phylogeny and biogeography of the wall-lizard *Podarcis erhardii* (Squamata: Lacertidae). *Molecular Phylogenetics and Evolution* **28**: 38-46.
- Tamar, K., Maza, E., Meiri, S. (2013): *Ophisops elegans* (Snake-Eyed Lizard). Bifurcation. *Herpetological Review*, **44**(1): 146.
- Uetz, P., Freed, P., Hošek J. (2017): *Podarcis erhardii*, The Reptile Database. Available at: <http://www.reptile-database.org>. Last accessed on 20 January 2017.
- Valakos, E.D., Adamopoulou, C., Maragou, P., Mylonas, M. (1997): The food of *Podarcis milensis* and *Podarcis erhardii* in the insular ecosystems of the Aegean. In: *Herpetologia bonnensis*, p. 373-381 in Böhme, W., Bischoff, W., Ziegler, T., Eds., Societas Herpetologica Europea, Bonn.
- Valakos, E.D., Pafilis, P., Lymberakis, P., Maragou, P., Sotiropoulos, K., Foufopoulos, J. (2008): The amphibians and reptiles of Greece. Edition Chimaira, Frankfurt, Germany.
- Vervust, B., Van Dongen, S., Grbac, I., Van Damme, R. (2009): The mystery of the missing toes: extreme levels of natural mutilation in island lizard populations. *Functional Ecology* **23**: 996-1003.