Melanism in European plethodontid salamanders

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Abstract

Melanism represents a well known chromatic aberration within reptiles, but very few information is available on amphibians. During five-years of field surveys we observed more than 3000 individuals of European cave salamanders (genus *Hydromantes*), five of which showed melanistic pattern. Our observations report the first cases of melanism for European cave salamanders.

Abnormal or uncommon patterns of pigmentation have been reported in herpetological literature since its beginnings and are yet of great interest for zoologists and keepers. Chromatic abnormalities are well known within amphibian species (Hoffman & Blouin 2000; Rivera et al. 2001). The most usually reported abnormalities involve the reduction (total or partial) of chromatophores: this is the case of albinism and leucism (Dyrkacz 1981). In this circumstance, individuals show white/pale coloration and these traits may determine a low viability (Toledo et al. 2011). On the other hand, cases in which pigmented-cells are more abundant than in normal individuals (axanthism and melanism) are less often described within amphibians (Jablonski et al. 2014). In fact, besides the salamander species that are naturally melanistic (e.g., Lanza's alpine salamanders, *Salamandra lanzai* and alpine salamander *S. atra* in Europe) only few cases of dark coloration are reported in literature and mainly deal with anuran species (Alho et al. 2010; Riobo et al. 1999). To our knowledge, cases of melanism in salamandrid species concern just four taxa: *S. salamandra*, *Triturus marmoratus*, *Euproctus asper* and *E. montanus* (Manenti 2006; Rivera et al. 2001). Contrary to albinism and leucism, an increase of dark pigmented-cells might even be advantageous, for instance because melanistic individuals may gain heat more quickly, and thus spend less time basking and reduce exposition to predatory risk (Clusella Trullas et al. 2007; Vences et al. 2002).

Here we report the first observations of melanism in European plethodontids (genus *Hydromantes*). During 2012-2016, we investigated populations of the eight species of European *Hydromantes*, and observed more than 3000 individuals: (*H. strinatii*: 164, *H. ambrosii*: 593, *H. italicus*: 546, *H. flavus*; 302, *H. supramontis*: 392, *H. imperialis*: 900, *H. sarrabusensis*: 103 and *H. genei*: 275). We detected a total of five melanistic individuals in three of the eight species: *Hydromantes flavus* (3), *H. imperialis* (1) and *H. ambrosii bianchii* (1). In 2014 we found one melanistic juvenile *H. imperialis* (total length: 3 cm) in a cave located in Ogliastra district (Eastern Sardinia, Lat. 39.85° Lon. 9.46°) (Figure 1a) and one melanistic adult female of *H. a. bianchii* (total length: 11 cm) in the La Spezia district (Eastern Liguria, Lat. 44.08° Lon. 10.02°) (Figure 2a). In

two occasions (2015 and 2016) we found melanistic *H. flavus* in a cave located in Nuoro district (North-eastern Sardinia, Lat. 40.46° Lon. 9.52°): the first individual was a female (total length: 12 cm; Figure 2c); the second one was a juvenile (total length: 7.5 cm, Figure 1b). Finally, in another cave of the Nuoro district (Lat. 40.51° Lon. 9.61°), in 2015 we found one adult melanistic male with total length of 11 cm (Figure 2b). All melanistic salamanders showed a dark pigmentation covering most of upper part of their body. In *H. flavus* adults (Fig. 2b-c). both limbs and flanks showed a more pale dark colouration, as normally these body parts are lighter or totally depigmented (Lanza et al. 2006).

Even if extensive studies have been performed on European plethodontids, no mention to melanistic individuals were reported (Lanza et al. 1995; Lanza et al. 2006). In fact these species normally have a cryptic habitus, avoiding direct exposure to the sun and becoming thermally conform with exploited environment (Lunghi et al. 2016). Our findings indicate that melanism represents a quite rare condition in *Hydromantes* salamanders, but that can be observed both in juveniles and adults.

Our study provides the first observations of melanistic patterns occurred in European plethodontids.

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Figure 1. Melanistic juvenile of *Hydromantes imperialis* found during early summer of 2014 (A) and melanistic juvenile of *H. flavus* found in spring 2016 (B).

Figure 2. Three melanistic adults of *Hydromantes*: (A) *H. ambrosii* found in summer 2014; (B) a female and (C) a male (C) *H. flavus* found in autumn 2015.

122 Figure 1

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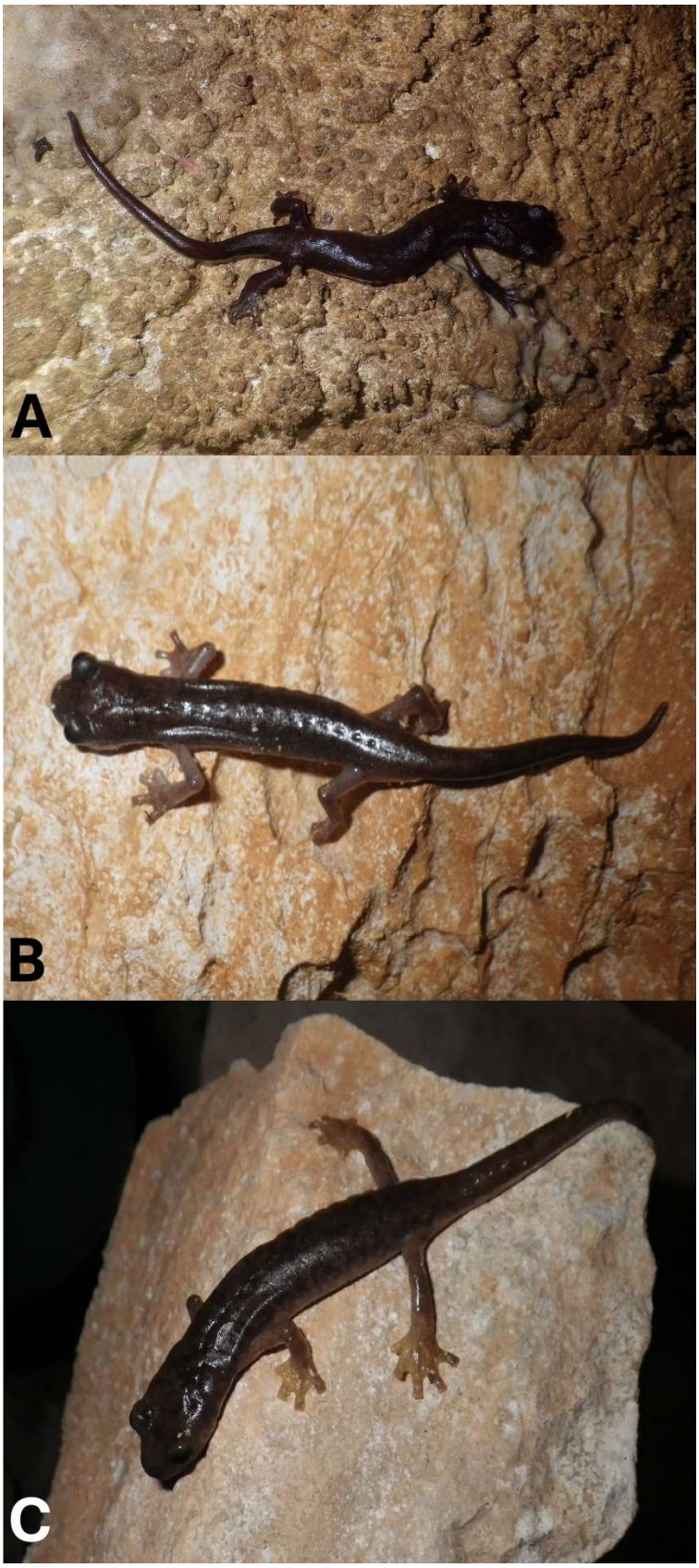
125 Figure 2



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