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The common toad (*Bufo bufo*) - dark coloration

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Colour anomalies in amphibians may act as bioindicators of disrupted environments (Henle et al., 2017a). Melanism (abnormally black coloration) is an anomaly that may cover part or all of the body. Its proximal cause is an over-representation of eumelanin, usually due to an excess of melanophores (Henle et al., 2017a) and a reduction of xantophores and iridophores, which may have a genetic basis linked to xanthine dehydrogenase (Bagnara et al., 1978). Melanism can be caused by UV-B radiation but natural, ambient, radiation of this type was proven to play no part in the genesis of melanism in the Common Toad (*Bufo bufo*) (Langhelle et al., 1999). In amphibians, melanism can be innate (hence heritable, as in *Salamandra salamandra*; Henle et al., 2017a), or be developed as a physiological reaction to specific conditions (as in *S. keyserlingii*; Henle et al., 2017b). Innate melanism can be a result of anthropogenic mutagenesis. Axanthism, on the other hand, is caused by a lack of particular pigment cells - iridophores, xantophores and erythrophores (Jablonski et al., 2014). This colour anomaly, rarer than albinism or melanism, is characterised by blue/grey or dark coloration with black eyes and has been observed in *Bufotes viridis* (Ibid.). Full axanthism can be mistaken for melanism but axanthic specimens tend to have discernable patterns and be lighter in colour as they differ from melanistic specimens in having no overproduction of melanin (Ibid.). It is thought that both genetic and environmental factors contribute to axanthism (Ibid.).

The common toad (*B. bufo*) is a fairly common amphibian in Poland (Juszczyk, 1986) that tolerates disturbed environments (Speybroeck et al., 2016; Kaczmarski et al., 2016). This species is common throughout almost all Europe (Speybroeck et al., 2016) and as a result it has been one of the best-studied tailless amphibians. Axanthism has been described in *B. bufo* (Dubois, 1969) but in the case of melanism only black spots on adult (Mattes, 2013) and juvenile (Kliemt, 2017) have been reported and it has been assumed that these were caused by a fungal disease.

On the 20th of June 2011 a number of freshly metamorphosed *B. bufo* were seen dispersing from the banks of a body of water in an active sand and gravel quarry next to fields on the outskirts of Gorzów Wielkopolski (Western Poland)- 52° 46'50.6" N, 15° 14'29.1" E. A minority (>10) of them were very dark- their skin and eye colour was black and this coloration did not change over half an hour. Their behaviour was not different from that of normally-coloured toadlets and no pathological changes were seen. Histological samples were not obtained but photos were taken. A year later (11th June 2012), at the same location, another group of unusually dark freshly metamorphosed common toads was observed and photos of specimens were once again taken. In the following years, after the quarry had been shut down, no other abnormally dark specimens were observed at that site.

Figure 1. Freshly metamorphosed common toads, normally coloured (left) and unusually dark (right)

It is suggested that the quarry may have been using chemicals that contaminated the water and caused mutations in the common toad eggs and/or adults. The disappearance of these black toads may be due to the fact that this coloration is not adaptive. Melanistic reptiles may gain thermal advantages from their coloration but this would not appear to be an advantage for toads as they do not bask in sunshine, preferring to remain at relatively low temperatures. Melanism or axanthism could be advantageous to toads that live on black backgrounds as this would provide camouflage but the habitat of this toad population did not appear to offer black backgrounds and so instead the black toads may have been at a disadvantage being more easily seen by predators.

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