

## First report of piebaldism in scolecophidians: a case of *Typhlops vermicularis* (Squamata: Typhlopidae)

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There is great discrepancy in the use of the terms related to atypical colourations resulting from a deficiency of colour pigments. Such conditions may affect the entire body or only parts of it and include albinism (a pigment-cell disorder, where melanocytes fail to produce normal amounts of melanin), leucism (a skin disorder which includes deficiencies in all types of skin pigments), and piebaldism (random, i.e. non-patterned patches of pigmented and non-pigmented cells), also referred to as “partial albinism” or, erroneously, “partial leucism” (Bechtel, 1991). The last condition is usually caused by developmental anomalies in the differentiation of the pigment cells, it does not necessarily involve genetic mutations and may be restricted to specific body regions generating a “piebald” phenotype (Acevedo, Torres and Aguayo-Lobo, 2009).

The Eurasian blindsnake, *Typhlops vermicularis* Merrem, 1820 (Squamata, Serpentes, Scolecophidia, Typhlopidae), is a small burrowing wormlike snake. Its body measures 14–76 cm in total length, and it is covered with smooth rounded scales, with ventral and dorsal scales having approximately equal size. The top of the head is covered with large shields, the eyes are strongly reduced looking as dark spots and the tail is short, with a spine at the tip. The colouration varies from light brown, pinkish or flesh-coloured to dark brown or gray. In several cases, the vent is lighter than the dorsum.

On 27 April 2009 (approx. at 12:00), during a herpetological field survey, two specimens of Eurasian blindsnake were found by Dr. E. Thanou and the author, under the same stone in Makri village, Evros pref.,

Thrace, Greece (40°51'21.51”S, 25°44'43.84”W, 70 m a.s.l.). One of them had the natural colouration described above, while the second one presented an unusual colour pattern. Although parts of the animal’s skin, especially the front half of the body and the entire head, were dark pinkish, several smaller and larger white patches were also visible, with the posterior half of the body being mostly white (Fig. 1). The specimen was photographed, collected and deposited in the herpetological collection of the Zoological Museum of the University of Patras (Greece). Tissue sampling, DNA extraction and sequencing of both mtDNA and nDNA markers were also conducted. The individual was genetically identical to most specimens of *T. vermicularis* from Greece (Kornilios et al., 2012; specimen #39 in their Appendix).

It must be noted that during the past years (2008-2013) the author has examined more than 500 Eurasian blindsnakes (collected specimens and museum specimens), none of which presented any type of colouration disorder. Additionally, this is the first report of a scolecophidian exhibiting piebaldism, and only the second published report of a scolecophidian exhibiting any colouration disorder. The first reported case was about an albino *Gryptoptyhops acutus* from India (Nivalkar et al., 2012).

Albinism seems to occur primarily in snake species that are either cryptozoic, or are venomous (Sazima and di-Bernado, 1991). In general, wild albino and leucistic animals are rare (Krecsák, 2008 and references therein), due to their low survival rates, with multiple explanations discussed in the literature. However these explanations, briefly described below, seem to be implausible for scolecophidians due to their lifestyle. Specifically:

(1) Snakes presenting chromatic anomalies may hatch stillborn or with malformations and are also detected more easily by prey and predators, resulting in negative impacts on their feeding, survival and reproduction (Krecsák, 2008).



**Figure 1.** Several views of the piebald *Typhlops vermicularis*, Makri, Evros, Greece.

(2) Albinos usually have vision problems (Creel, Summers and King, 1990; Garipis and Hoffmann, 2000; Hupfeld and Hoffmann, 2006), making them unable to perceive the signals of conspecifics (male-male and male-female interactions) and identify predators.

(3) Melanin protects organisms from solar radiation. Albinos have notably sun-sensitive skin (heliophobic), causing them much difficulty during their growth (Spadola and Di Toro, 2007).

(4) Melanin also functions in thermoregulation (Bechtel, 1978), with albino or leucistic reptiles being unable to thermoregulate properly.

However, scolecophidians (1) are blind or can only detect some grades of light and darkness, and perceive their environment, both abiotic and biotic (e.g. conspecifics, predators, prey) with other senses, and (2) they are strictly fossorial and therefore having pigmentation disorders should normally not affect their thermoregulation capacity and their detection from predators or act negatively regarding sun-exposure. In this regard, we expect that chromatic disorders would not be phased out by natural selection to the same extent as in other snakes, and, subsequently, to be more frequent in scolecophidians. The rarity of such records could be due to the fact that these snakes are largely understudied (Vidal et al., 2010), than to the alternative of lower survival rates compared to other major groups of reptiles.

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