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Rare colour aberrations and anomalies of amphibians and reptiles recorded in Poland

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Animal colouration plays an important role in many aspects of animal ecology (e.g. Bechtel, 1995) and may have important implications for animal fitness (e.g. Andrén and Nilson, 1981). This may be especially significant for ectothermic animals such as amphibians and reptiles, in which some colour anomalies may have an effect on thermal biology (e.g. Clusella Trullas et al., 2007), apart from survival or ecology. Such anomalies may be important for our understanding of ecological history or phenotypic plasticity of species (e.g. Boero, 2013). Colour anomalies of amphibians and reptiles have rarely been described from Poland. Most of these were merely anecdotal reports, without detailed information (e.g. Juszczyk 1987a, 1987b). Reports of aberrant colorations frequency were much rarer and most commonly restricted to single anomaly in single species (e.g. case of melanistic *Natrix natrix* in the Bieszczady; Błażuk, 2007). However, Maślak (2000) sampled sand lizards (*Lacerta agilis*) from the whole territory of Poland and described erythronotus form as the most common (6.2% of 258 individuals). Moreover, some relatively poorly known or often-overlooked anomalies (e.g. axanthism) so far have not been recorded and knowledge on their distribution in amphibians and reptiles in Poland is thus still very scarce or non-existent. Herein, we present observations of several rare or previously unreported colour anomalies of several amphibian and reptile species from Poland.

During the night of 13 April 2013 (cloudy, below 10ºC) on the asphalt road in Gorzyce Wielkie village (51.6378ºN, 17.7419ºE) we observed *Pelobates fuscus* with red colour of its dorsal body part. The red covered almost whole dorsal part of the body, being less pronounced on limbs. The background colouration was visible (Fig. 1A). Later, in the nearby Barycz Valley we observed numerous similarly coloured individuals. Similar colouration, but with red covering the background colour, was also observed in several individuals from Poznań (52.4375ºN, 16.8753ºE). Normally, the spadefoot toad has yellow-greyish, olive or brown dorsal colouration with several large spots, darker than the background colour (e.g. Juszczyk, 1987a). This author described also several flavistic individuals from Poland, with pale-orange colouration. Red dorsal points are common in spadefoot toads – especially in the Italian subspecies *P. f. insubricus*, in which they can even cover the background colouration (Andreone et al., 1993), as in the individuals from Poznań, but unlike the spadefoot toads from Gorzyce Wielkie and the Barycz Valley. However, to our knowledge, such degree of erythrism was not previously reported for the nominal subspecies of the spadefoot toad. We hypothesize that such erythristic colouration may be a result of high concentration of iron in water and soil in the Barycz Valley and surrounding area, similarly to some birds which acquire pigment from iron-oxide deposits (McGraw et al., 2005). This region is rich in deposits of bog iron ore, which were used as building material and some of the ponds were created in the excavation of ore exploitation (Chłapowski, 1910; Ratajczak and Skoczylas, 1999). This may be especially important for the spadefoot toad, as it is the most burrowing amphibian living in that area.

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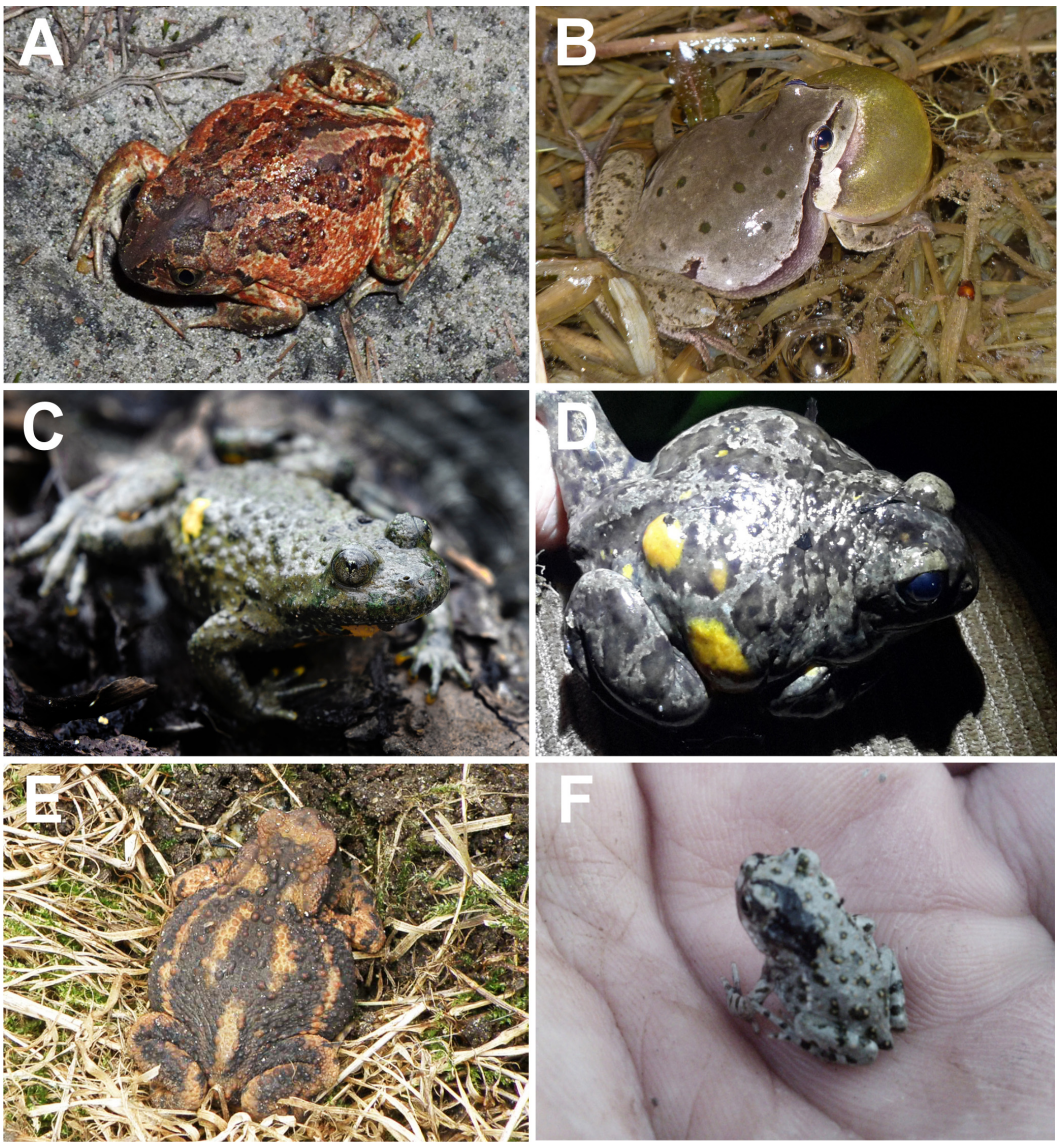

Figure 1. Colour anomalies in amphibians from Poland. A) Erythrism in *Pelobates fuscus*; B) brown colouration in *Hyla arborea*; C) yellow dorsal spots in *Bombina variegata*; and D) *Pelobates fuscus*; E) possible partial axanthism in *Bufo bufo*; F) dark spot on a juvenile *Bufotes viridis*. Photos by K. Kolenda (A, B), A. Najbar (C), J.M. Kaczmarek (D), T. Skawiński (E) and P. Kaczmarek (F).

On 26 April 2012, on a warm and clear night, we observed 21 European tree frogs (*Hyla arborea*) in a pond in a melaphyre quarry near Tłumaczów in the Kłodzko Valley (50.5581ºN, 16.4347ºE; 370 m a.s.l.). Of these 21 individuals, 19 were typically, green coloured. Two males (9.5%) had brown-greyish dorsal colouration, with several green spots on the back (Fig. 1B). One of those two individuals did not regain green colouration after catching and remained grey-brownish for at least several hours outside the pond and after release. The European tree frogs normally have uniformly green dorsal colouration but are able to change the hue in response to different ecological or physiological stimuli. In some cases, even single individual can exhibit several

different colours (Nielsen, 1980). Tree frogs often return to normal green colouration shortly after cessation of the stimulus (e.g. Juszczyk, 1987a; Đorđević et al., 2016). Dorsal spots similar to those in individuals described above were observed in several individuals of the European tree frog by Koren and Jelić (2011) in Croatia, but absent in similarly coloured individuals in Poland and Serbia (e.g. Juszczyk, 1987a; Đorđević et al., 2016). Thus, it is to our knowledge the first case of such colouration in a tree frog in Poland. The fact that one of those individuals did not regain green colour may suggest that at least some individuals can retain their changed colouration for longer periods than previously assumed, however it is difficult to assess if the brown-colour trait is fixed without additional support of a histochemical analysis (Nielsen, 1980). Moreover, in some other tree frog species both changeable and fixed colour forms occur (e.g. Wente and Phillips, 2003).

On a very warm day on 24 July 2009 in a puddle in the Bieszczady Mountains (Sękowiec; 49.2333ºN, 22.5500ºE) we observed a yellow-bellied toad (*Bombina variegata*) with a large yellow spot on a dorso-lateral side of the body, isolated from yellow spots on the venter (Fig. 1C). Otherwise, the colouration was typical. At least 10 typically coloured individuals were observed at the same locality. Normally, the yellow-bellied toads have large, conspicuous yellow spots on the venter but dorsal side of the body is grey or brownish, cryptically coloured. The aposematic ventral colouration is exposed in a defensive posture – the unkenreflex (Juszczyk, 1987a). Individual described above was an adult in good condition, which suggests that a conspicuous spot on a normally cryptically coloured dorsum did not result in a decrease of its fitness, possibly because these toads occur in smaller water bodies than *B. bombina*, where smaller number of predators are present (Bajger, 1980).

Several yellow spots were observed also on dorsal side of a spadefoot toad found on 8 April 2015 near pond surrounded by fields and forest in suburbs of Poznań (52.3058ºN, 16.9861ºE). The pond is located near allotment garden and is eutrophic and highly polluted by fertilisers and pesticides. Two yellow dorsal spots were relatively large (approximately 5-10 mm) but several others were merely yellow points (about 1 mm). Otherwise, the colouration was typical (Fig. 1D). The individual was in good condition. Three normally coloured spadefoot toads were also present in that locality. Flavism seems to be a rare morph in amphibians and, to our best knowledge, this is the first report of partial dorsal flavism in both yellow-bellied toads and spadefoot toads, although albinism is known in both of these species (Rivera et al., 2001).

We observed an atypically coloured common toad (*Bufo bufo*) under a sheet of plastic near the sand road in Sulistrowiczki (50.8958ºN, 16.7306ºE) on a warm (24°C) and sunny day on 11 June 2015. It had dark grey, nearly black dorsal colouration, covering almost whole dorsal side of the body, except for five lighter longitudinal stripes, located symmetrically on both sides of the body (Fig. 1E). In the same locality, we observed five normally coloured individuals. Dorsal colouration of the common toad is most commonly uniformly brown. Some individuals have small darker spots, which do not make a regular pattern (Juszczyk, 1987a). Young toads and some larvae may have red or reddish colouration (Juszczyk, 1987a; Zakharova et al., 2012). Colour anomalies seem to be rare in that species and include albinism (Juszczyk, 1987a), flavism (Thomas et al., 2002), axanthism (Dubois, 1969; Jablonski et al., 2014) and melanism (Dyrcz et al., 2013). While the colouration of the individual from Sulistrowiczki was much darker than the one normally occurring in common toads, it is not dark enough to consider it a case of melanism. However, axanthic individuals show grey or generally dark colouration (Jablonski et al., 2014), so that individual can probably be considered an example of partial axanthism in the common toad. To our knowledge, this is also the first report of light, symmetrical, contrasting stripes on dark coloured individual of that species.

A juvenile common toad observed on 2 August 2010 (warm, cloudy, no rain) in a polluted by heavy metals and drying pond in suburbs of Ostrów Wielkopolski city (51.6378ºN, 17.8365ºE) had a large, irregular dark spot on its dorsal side of the body. Several dozens of other toads were observed at the same time and none of them exhibited similar aberration. Similar spot was observed on a juvenile green toad (*Bufotes viridis*) recorded on 26 July 2012 near the former clay-pit at Krasiejów (50.6656ºN, 18.2755ºE). No other toads were observed at the site. The spot was relatively slightly larger and located more anteriorly in the green toad than in the common toad (Fig. 1F). Otherwise, both individuals were normally coloured. These spots are probably not dark enough to consider them examples of partial melanism but may represent partial axanthism. Only several colour anomalies have been reported in green toads, including axanthism, albinism, erythrism and retinal depigmentation (Jablonski et al., 2014 and references therein).

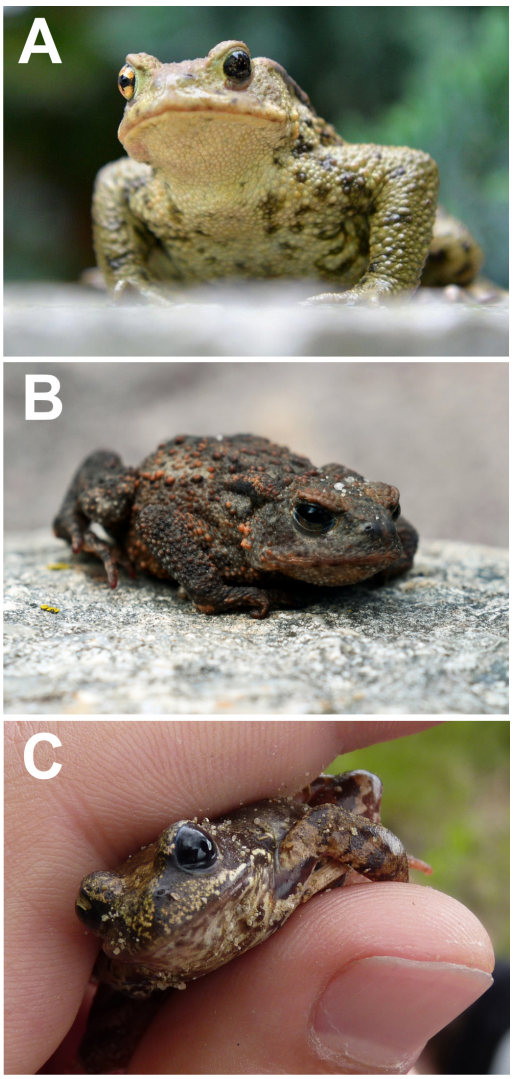

Figure 2. Eye depigmentation in amphibians from Poland. A) *Bufo bufo* with left iris depigmented and B) with partial depigmentation of right iris; C) *Rana temporaria* with black left eye. Photos by B. Najbar (A), A. Najbar (B) and K. Kolenda (C).

On 25 May 2016 (17ºC, cloudy) in the Central Odra Valley (51.9479ºN, 15.7755ºE) we observed a common toad (*B. bufo*) with black left iris (Fig. 2A). On a moderately warm (17ºC) and sunny day on 14 May 2012 in Zielona Góra-Ochla (51.8716ºN, 15.4667ºE) we observed an individual of common toad with one of the irises partially depigmented (Fig. 2B). Occurrence of black eye or eyes is generally thought to be a result of recessive mutation (e.g. Vershinin, 2004). Such anomaly is also one of the three main types of axanthism in amphibians listed by Jablonski et al. (2014). Iris depigmentation is rare in this species and was previously reported only by Dubois (1969), and, to our knowledge, only partial eye depigmentation was hitherto unknown in that species. On a warm and sunny day of 28 May 2015 in fish ponds in Pruszowice near Wrocław (51.1870ºN, 17.1403ºE) we found a common frog (*Rana temporaria*) individual with black left eye (Fig. 2C). Several dozens of other common frogs with normally developed irises were observed. Such anomaly has been described in numerous moor frogs (*R. arvalis*), yet it was reported only in single common frog individuals (Rostand, 1953; Vershinin, 2004). All three amphibians described above had normal body colouration and none of them exhibited any signs of physical injuries, including around the eyes.

We observed completely melanistic individuals of common lizard (*Zootoca vivipara*) in several different environments. One black coloured, probably gravid, female (Fig. 2A) was observed on 8 July 2006 in the Gąsienicowa Valley, the Tatra Mountains, on a site covered by mountain pines *Pinus mugo* (49.2594ºN, 19.9989ºE; 1370 m a.s.l.). It was a warm and partly cloudy day. About five non-melanistic individuals were also observed. The lizards were basking on logs near the path. On 25 March 2012, we observed melanistic male of this species (Fig. 2B) near melaphyre quarry in Tłumaczów. In this site, about five typically coloured common lizards were recorded. While this locality is in the Sudetes, it is on relatively low altitude (370 m a.s.l.). Moreover, melanistic common lizards were observed in forests near Ostrów Wielkopolski and Odolanów (K. Dudek, pers. comm.), about 100 km from the nearest mountains. The common lizard shows wide variation in the dorsal colouration, most commonly, it is brown with dark longitudinal stripes and small light dots (e.g. Juszczyk, 1987b). Melanism is not uncommon in this species but individuals with completely black colouration are rare (e.g. Juszczyk, 1987b). Such melanistic individuals were observed in different localities throughout its range (e.g. Gvoždík, 1999; San-Jose et al., 2008; Jambrich and Jandzik, 2012), but very rarely in Poland (Juszczyk, 1987b; Błażuk, 2007). Melanism is generally believed to give a thermal advantage to reptiles, thus allowing them to live in colder habitats, including high altitudes (Clusella Trullas et al., 2007). However, this is ambiguous in the case of small lizards, such as the common lizard, in which melanistic individuals relatively frequently occur

Figure 3. Colour anomalies in reptiles from southern Poland. Melanism in A) a gravid female, B) male of *Zootoca vivipara*; and C) *Natrix natrix*; D) Hypomelanistic individual of *Zamenis longissimus* along a normally coloured individual (above). Photos by P. Kaczmarek (A), K. Kolenda (B), A. Najbar (C) and B. Najbar (D).

in lowlands (e.g. Gvoždík, 1999; Jambrich and Jandzik, 2012).

On 15 June 2012 (warm and sunny day), a melanistic individual of the grass snake (*N. natrix*) was found in Zatwarnica in the Bieszczady Mountains (49.2400ºN, 22.5547ºE; 492 m a.s.l). It was almost completely black – whole dorsal side of the body was black, no collar was visible, and only parts of some labial scales and ventral side of the mandible were white (Fig. 2C). Three other, non-melanistic individuals were also observed. The grass snake displays highly variable colouration (Najbar and Borczyk, 2012). Several colour anomalies

were recorded, including rare melanism or exceptional albinism (e.g. Najbar and Borczyk, 2012). Melanistic grass snakes were reported from many localities in Europe and Asia Minor (e.g. Göçmen et al., 2011). Such coloured individuals are not uncommon in the Bieszczady and may constitute over 10% of snakes in some populations (Najbar and Borczyk, 2012), yet completely or almost completely black individuals are rare and do not exceed 5% in that area (Jandzik, 2004; Błażuk, 2007).

A light grey adult individual of the Aesculapian snake (*Zamenis longissimus*) before skin-shedding was observed on a warm and cloudy day on 27 May 2012 in Krywe, the Bieszczady Mountains (49.2562ºN, 22.5291ºE; 486 m a.s.l.). A normally coloured individual was also present at the site (Fig. 2D). Adult individuals typically have brown or olive-brown dorsal and lateral colouration, with numerous light spots (Najbar, 2004). Several colour anomalies, including melanism, erythrism, albinism, and axanthism are known in that species (e.g. Najbar, 2004; Zadravec and Lauš, 2011; Cattaneo, 2015). As the individual described above had a much lighter colouration than normally coloured Aesculapian snakes, such colouration was probably a result of reduction of amount of melanin, i.e. hypomelanism. Such anomaly is known to occur in e.g. smooth snake (*Coronella austriaca*) (Lauš and Burić, 2011) but has not previously been reported in the Aesculapian snake. Body condition of the hypomelanistic individual was good, which suggests that the anomaly did not reduce the snake's fitness.

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References

Andreone, F., Fortina, R., Chiminello, A. (1993): Natural history, ecology and conservation of the Italian spadefoot toad, *Pelobates fuscus insubricus*. Torino, Italy, Zoological Society "La Torbiera" – Scientific Reports n. 2.

Andrén, C., Nilson, G. (1981): Reproductive success and risk of predation in normal and melanistic colour morphs of the adder, *Vipera berus*. Biological Journal of the Linnean Society **15**: 235–246.

Bajger, J. (1980): Diversity of defensive responses in populations of fire toads (*Bombina bombina* and *Bombina variegata*). Herpetologica **36**: 133–137.

Bechtel, H.B. (1995): Reptile and amphibian variants: colors, patterns, and scales. Malabar, FL, Krieger Publishing.

Błażuk, J. (2007): Herpetofauna Doliny Sanu pod Otrytem i terenów przyległych (Bieszczady Zachodnie). Gady. Roczniki Bieszczadzkie **15**: 181–229.

Boero, F. (2013): Observational articles: a tool to reconstruct ecological history based on chronicling unusual events. F1000Research **2**: 168. DOI: 10.12688/f1000research.2-168.v1

Cattaneo, A. (2015): The *Zamenis longissimus* (Laurenti) axanthic phenotype found on the Castelporziano Presidential Estate: considerations on its morphology, genetic nature and probable extinction (*Serpentes*: *Colubridae*). Rendiconti Lincei **26**: S385–S389.

Chłapowski, F. (1910): Wiwianitowe i żelaziakowe złoża u źródlisk Baryczy. Ziemia **I**: 386–387.

Clusella Trullas, S., van Wyk, J.H., Spotila, J.R. (2007): Thermal melanism in ectotherms. Journal of Thermal Biology **32**: 235–245.

Đorđević, S., Simović, A., Krizmanić, I., Tomović, L. (2016): Colour variations in the European tree frog, *Hyla arborea* (Linnaeus, 1758), from two small adjacent ponds in the Vojvodina province, Serbia. Ecologica Montenegrina **5**: 18–21.

Dubois, A. (1969): Sur un crapaud commun aux yeux noirs. Bulletin mensuel de la Société linnéenne de Lyon **38**: 105–106.

Dyrcz, A., Gramsz, B., Maślak, R., Witkowski, A., Zając, T., Dobrowolska-Martini, K., Kotusz, J., Kusznierz, J., Leś, E., Martini, M., Popiołek, M., Rąpała, R. (2013): Kręgowce. In: Przyroda Karkonoskiego Parku Narodowego, p. 411–448. Knapik, R., Raj, A., Eds., Jelenia Góra, Poland, Wydawnictwo Karkonoskiego Parku Narodowego.

Göçmen, B., Mebert, K., Akman, B., Yalçınkaya, D., Kariş, M., Erturhan, M. (2011): New locality records of snakes resembling the Big-headed Grass Snake, *Natrix megalocephala* Orlov & Tuniyev, 1987 (Ophidia: Colubridae) in Turkey. North-Western Journal of Zoology **7**: 363–367.

Gvoždík, L. (1999): Colour polymorphism in a population of the common lizard, *Zootoca vivipara* (Squamata: Lacertidae). Folia Zoologica **48**: 131–136.

Jablonski, D., Alena, A., Vlček, P., Jandzik, D. (2014): Axanthism in amphibians: A review and the first record in the widespread toad of the *Bufotes viridis* complex (Amphibia: Bufonidae). Belgian Journal of Zoology **144**: 93–101.

Jambrich, A., Jandzik, D. (2012): Melanism in the topotypic population of the Pannonian subspecies of the common lizard, *Zootoca vivipara pannonica* (Reptilia: Lacertidae). Herpetology Notes **5**: 219–221.

Jandzik, D. (2004): Partial melanism in the grass snake *Natrix natrix* (Reptilia: Colubridae) from northeastern Slovakia. Acta Zoologica Universitatis Comenianae **46**: 75–77.

Juszczyk, W. (1987a): Płazy i gady krajowe. Część 2. Płazy – Amphibia. Warszawa, Poland, Państwowe Wydawnictwo Naukowe.

Juszczyk, W. (1987b): Płazy i gady krajowe. Część 3. Gady – Reptilia. Warszawa, Poland, Państwowe Wydawnictwo Naukowe.

Koren, T., Jelić, D. (2011): Interesting color forms of the European tree frog, *Hyla arborea* (Linnaeus, 1758) (Amphibia: Ranidae) from Croatia. Hyla **2**: 27–29.

Lauš, B., Burić, I. (2011): Colour abnormalities in *Coronella austriaca* (Laurenti, 1768) in Croatia. Hyla **2**: 43–44.

Maślak, R. (2000): Anomalie barwne u Lacertidae. In: Biologia płazów i gadów. Materiały z V Ogólnopolskiej Konferencji Herpetologicznej, p. 78–79. Zamachowski, W., Ed. Kraków, Poland, Wydawnictwo Naukowe Akademii Pedagogicznej.

Nielsen, H.I. (1980): Color and color adaptation of the European tree frog, *Hyla arborea*. Journal of Experimental Zoology **211**: 143–151.

McGraw, K.J., Hudson, J., Hill, G.E., Parker, R.S. (2005): A simple and inexpensive chemical test for behavioral ecologists to determine the presence of carotenoid pigments in animal tissues. Behavioral Ecology and Sociobiology **57**: 391–397.

Najbar, B. (2004): Wąż Eskulapa. Świebodzin, Poland, Wydawnictwo Klubu Przyrodników.

Najbar, B., Borczyk, B. (2012): Zaskroniec zwyczajny. Biologia i ochrona. Zielona Góra, Poland, Oficyna Wydawnicza Uniwersytetu Zielonogórskiego.

Ratajczak, T., Skoczylas, J. (1999): Polskie darniowe rudy żelaza. Kraków, Poland, Wydawnictwo Instytutu Gospodarki Surowcami Mineralnymi i Energią PAN.

Rivera, X., Arribas, O., Martí, F. (2001): Revisión de anomalias pigmentarias en los anfibios de la Península Ibérica y de Europa. Bulleti de la Societat Catalana d'Herpetologia **15**: 59–75.

Rostand, J. (1953): Sur l'anomalie « iris brun » chez *Rana esculenta* L. et chez *Rana temporaria* L. Comptes Rendus de l'Academie des Sciences **237**: 762–764.

San-Jose, L.M., Gonzalez-Jimena, V., Fitze, P.S. (2008): Frequency and phenotypic differences of melanistic and normally colored common lizards, *Lacerta* (*Zootoca*) *vivipara* of the southern Pyrenees. Herpetological Review **39**: 422–425.

Thomas, M., Rottscheidt, R., Hachtel, M. (2002): Ein Fall von Flavinismus bei der Erdkröte *Bufo bufo* (Linnaeus, 1758) nahe Bonn. Salamandra **38**: 119–123.

Vershinin, V.L. (2004): Frequency of iris depigmentation in urban populations of *Rana arvalis* frogs. Russian Journal of Ecology **35**: 58–62.

Wente, W.H., Phillips, J.B. (2003): Fixed green and brown color morphs and a novel color-changing morph of the Pacific tree frog *Hyla regila*. American Naturalist **162**: 461–473.

Zadravec, M., Lauš, B. (2011): Melanism variations in *Natrix natrix* (Linnaeus, 1758) and *Zamenis longissimus* (Laurenti, 1768) in Croatia. Hyla **2**: 39–42.

Zakharova, L.A., Surova, G.S., Timofeev, K.N. (2012): Specific features of the melanophore system in different color morphs of larvae of the common toad (*Bufo bufo* L.). Biology Bulletin **39**: 307–315.

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