AFRICAN HERP NEWS
AHN
NATURAL HISTORY
notes

BUFONIDAE

Sclerophrys poweri
(Hewitt, 1935)
Western Olive Toad

COLOURATION

P. BERG & F. S. BECKER

Natural and sexual selection drive the diversity of communication strategies in the animal world. Colour displays can function as visual signals transmitting information to inter- and intraspecific receivers, thereby impacting the fitness of an animal substantially. For example, in the context of predation, it may be protective to blend in with the environment (camouflage) or warn potential predators (aposematism) (Rojas 2017). Moreover, visual signals can facilitate mate recognition and choice, and complement acoustic communication in anurans. Whereas conspicuous colour displays may increase an individual's reproductive success, they may at the same time increase predation risk, hence resulting in a trade-off between different selective pressures. Sexual dichromatism, a form of sexual dimorphism in which males and females differ in colour, usually results from sexual selection for conspicuous colours in males and natural selection for cryptic colours in females and its prevalence and diversity in frogs and toads is increasingly recognized (Doucet and Mennill 2010; Bell and Zamudio 2012; Bell et al. 2017). Dynamic dichromatism refers to a temporary colour change between the sexes in the context of breeding, as opposed to a permanent or ontogenetic colour change, and is probably under-documented due to its ephemeral nature (Bell et al. 2017).

In the late evening of 26 April 2014, in the rain, a female *Sclerophrys poweri* was observed sitting in a hotel garden puddle (Fig. 1A) in Oshakati, Oshana region, Namibia (17° 47′ 08.1″ S 15° 41′ 56.4″ E, 1102 m a.s.l.). The toad displayed a very distinctive red dorsal body colouration, which covered the head, back, and, to a lesser extent, limbs and lateral body parts (Fig. 1 B, C). The normal colouration of *S. poweri* is yellow-brown to olive-green with pairs of dark-edged brown or reddish-brown patches and red infusions on the hindlegs (Du Preez and Carruthers 2017). A light throat and the absence of nuptial pads on the feet suggest that the encountered individual was female.

A similarly coloured female *S. poweri*

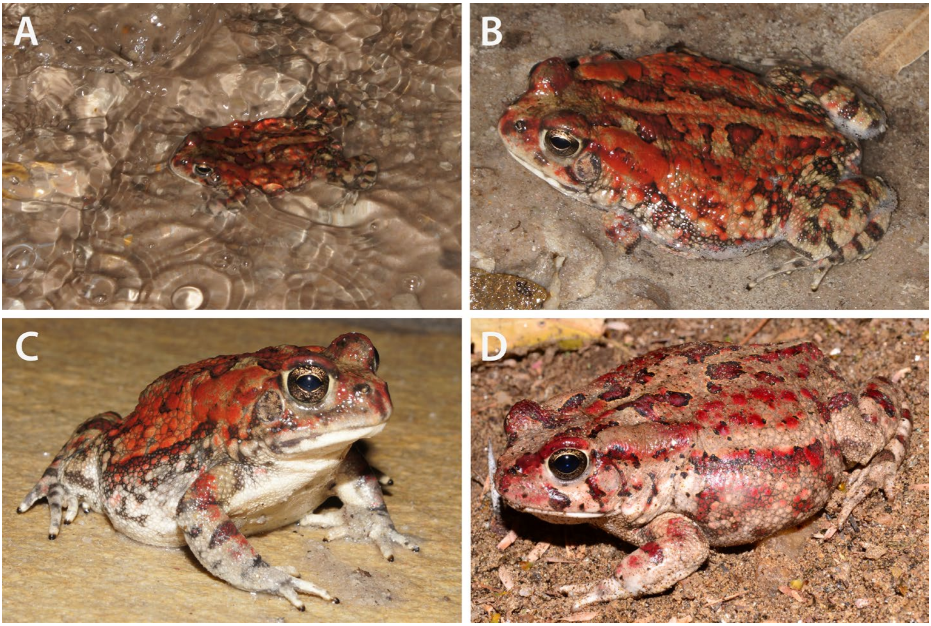

Figure 1. Conspicuous red pigmentation in the Western Olive Toad, *Sclerophrys poweri,* in Namibia. The first toad was encountered in a rain puddle in the late evening in Oshakati, Namibia (A). Dorsolateral (B) and frontolateral view (C) of the same individual. A second individual of *S. poweri* with a reddish dorsal body colouration was encountered in the rain at night in Windhoek, Namibia (D). (Photos: A–C: P. Berg; D: F. S. Becker)

was observed 550 km away in Windhoek, Khomas region, Namibia, on the first rainy night in the season on 23 October 2018 (Fig. 1D), about 10 m from a pool where these toads have been known to breed.

Both observations were made in the rain, under low light conditions. Amphibians possess two types of rod photoreceptors, which may allow for rod-based colour discrimination at very low light levels (Yovanovich et al. 2017). Bright colouration has been suggested to play a role in both sexual selection and mate recognition in nocturnal amphibians (Gomez et al. 2009; Gomez et al. 2010; Robertson and Greene 2017). While colouration linked to sexual selection is usually associated with males, the recognition of conspecifics affects both sexes, and can have several advantages in the breeding context. For example, males of the nocturnal treefrog *Hyla versicolor* are more likely to give courtship calls if they detect an approaching female (Reichert 2013), which may represent a strategy to balance the risk of being conspicuous to predators and the chances to attract attention of potential mates.

In the literature, information on the reproduction biology of *S. poweri* is scarce with the exception of Channing (2001), who states that the first rain in the season initiates breeding. Hence, there may be a link between the observed conspicuously red pigmentation and rain-triggered breeding activity. In related species breeding has been recorded at various times of the year (Conradie and Bills 2017). Anecdotal observations indicate that *S. poweri* may breed throughout spring and summer in perennial, usually artificial, water bodies, but that breeding activity is more pronounced after the first rain of the season. Although the toads were not collected and observed later, it is assumed that this colouration is temporal, because it is atypical for the species, even compared to sightings of conspecifics in Windhoek and northern Namibia. Moreover, if this conspicuous colouration was of permanent nature, the predation risk would be augmented and it seems unlikely that the individuals reached adult age. While colour or pattern polymorphism has been described for many anuran species, aberrant colour morphs characterized by an unusual reddish pigmentation (erythrism) have been reported less commonly. For example, erythristic specimens with red pigmentation confined to dorsal body parts and less pronounced on the limbs, similar to the case described here, have been documented for (female) *Bufo viridis* (Lanza and Canestrelli 2002) and for the toad *Pelobates fuscus* (Kolenda et al. 2017). Environmental factors, namely high iron concentrations in water and soil, rather than mutations affecting pigment production or chromatophores distribution, were hypothesized as a trigger in the latter case (Kolenda et al. 2017); alternative explanations, including dynamic sexual dichromatism, were not discussed.

Dynamic dichromatism has been described for males of other toads of the genus *Sclerophrys*, but not for females of any species. Males of *S. lemairii* (Lemaire's Toad) turn bright yellow during breeding periods (Bittencourt-Silva 2014; Conradie and Bills 2017) as do males of *S. kisoloensis* (Kisolo Toad), which revert to their normal colouration after a few hours (Channing and Howell 2006). According to an overview presented by Bell et al. (2017), dynamic dichromatism occurs fairly commonly in the family Bufonidae and a transient yellow or yellow-brown colouration has also been described for *S. gutturalis*, *S. maculatus* and *S. togoensis*. Other colours have been reported for male toads of the genus *Altiphrynoides,* which change to lime green or orange (Channing and Rödel 2019). However, a temporary shift to yellow coloration is by far the most common display colour in dynamically dichromatic frogs (Bell et al. 2017). If the colouration of the observed individuals of *S. poweri* represents sexual dichromatism, this case would be an exception to the norm in terms of colour and sex. While reports of "reverse" ontogenetic sexual dichromatism (i.e., more ornate coloration in females than in males) exist, it is assumed to have evolved in species with sex role reversal (e.g., Engelbrecht-Wiggans et al. 2019; Portik et al. 2019; but see Heinsohn et al. 2005 for an exception in a bird). For dynamic sexual dichromatism, all known cases refer to a temporary colour change in breeding males but one case of mutual dynamic colour change in both males and females of the bufonid *Xanthophryne tigerinus* (Bell et al. 2017). In addition, sexual dichromatism in the Wood Frog (*Rana sylvatica*) has been shown to follow a seasonal cycle in both sexes (Lambert et al. 2017), which hence may qualify as mutual dynamic sexual dichromatism. However, research on sexual selection that acts on females has only recently started to receive growing attention (Hare and Simmons 2019).

To our knowledge, this is the first record of such a bright red colouration in this species. Although widespread and common, many questions about the biology and phylogeny of these toads remain open, and numerous cryptic species may still await their discovery (e.g., Liedtke et al. 2016). In hyperoliid frogs, for example, sexual dichromatism has been linked to accelerated diversification (Portik et al. 2019) and more information about the breeding behaviour of *S. poweri,* related species as well as regional differences could add to our understanding of the evolution of African toads.

ACKNOWLEDGEMENTS

Many thanks to Alan Channing (University of the Western Cape) for valuable comments and to the reviewers whose advice improved the manuscript. PB owes special thanks to Jessica and Rainer Berg for travelling and sharing so many observations together.

REFERENCES

Bell RC, Webster GN, Whiting MJ. 2017. Breeding biology and the evolution of dynamic sexual dichromatism in frogs. J. Evol. Biol. 30: 2104–2115.

Bell RC, Zamudio KR. 2012. Sexual dichromatism in frogs: natural selection, sexual selection and unexpected diversity. Proc. R. Soc. Lond. B Biol. Sci. 279: 4687–4693.

Bittencourt-Silva G. 2014. Notes on the reproductive behaviour of *Amietophrynus lemairii* (Boulenger, 1901) (Anura: Bufonidae). Herpetol. Notes. 7: 611–614.

Channing A. 2001. Amphibians of Central and Southern Africa. New York: Cornell University Press.

Channing A, Howell KM. 2006. Amphibians of East Africa. New York: Cornell University Press.

Channing A, Rödel M-O. 2019. Field Guide to the Frogs and other Amphibians of Africa. Cape Town: Penguin Random House South Africa.

Conradie W, Bills R. 2017. Wannabe Ranid: notes on the morphology and natural history of the Lemaire's toad (Bufonidae: *Sclerophrys lemairii*). Salamandra 53: 439–444.

Doucet SM, Mennill DJ. 2009. Dynamic sexual dichromatism in an explosively breeding Neotropical toad. Biology letters 6: 63–66.

Du Preez L, Carruthers V. 2017. Frogs of Southern Africa: A complete guide. Cape Town: Struik Nature.

Engelbrecht-Wiggans E, Tumulty JP. 2019. "Reverse" sexual dichromatism in a Neotropical frog. Ethology. 125: 957–964.

Gomez D, Richardson C, Lengagne T, Plenet S, Joly P, Léna JP, Théry M. 2009. The role of nocturnal vision in mate choice: females prefer conspicuous males in the European tree frog (*Hyla arborea*). Proc. R. Soc. Lond. B Biol. Sci. 276: 2351–8.

Gomez D, Richardson C, Lengagne T, Derex M, Plenet S, Joly P, Léna JP, Théry M. 2010. Support for a role of colour vision in mate choice in the nocturnal European treefrog (*Hyla arborea*). Behaviour. 147: 1753–68.

Hare RM, Simmons LW. 2019. Sexual selection and its evolutionary consequences in female animals. Biol. Rev. 94: 929–956.

Heinsohn R, Legge S, Endler JA. 2005. Extreme reversed sexual dichromatism in a bird without sex role reversal. Science. 309: 617–619.

Kolenda K, Najbar B, Najbar A, Kaczmarek P, Kaczmarski M, Skawiński T. 2017. Rare colour aberrations and anomalies of amphibians and reptiles recorded in Poland. Herpetol. Notes. 10: 103–109.

Lambert MR, Carlson BE, Smylie MS, Swierk L. 2017. Ontogeny of sexual dichromatism in the explosively breeding wood frog. Herpetol. Conserv. Biol. 12: 447–456.

Lanza B, Canestrelli D. 2002. Atypische Färbung bei *Salamandrina terdigitata* (Lacepede, 1788) und *Bufo viridis viridis* Laurenti, 1768. Salamandra 38: 105–108.

Liedtke HC, Müller H, Rödel M-O, Menegon M, Gonwouo LN, Barej MF, Gvoždík V, Schmitz A, Channing A, Nagel P, Loader SP. 2016. No ecological opportunity signal on a continental scale? Diversification and life-history evolution of African true toads (Anura: Bufonidae). Evolution 70: 1717–1733.

Portik DM, Bell RC, Blackburn DC, Bauer AM, Barratt CD, Branch WR, Burger M, Channing A, Colston TJ, Conradie W, Dehling JM, Drewes RC, Ernst R, Greenbaum E, Gvoždík V, Harvey J, Hillers A, Hirschfeld M, Jongsma GFM, Kielgast J, Kouete MT, Lawson LP, Leaché AD, Loader SP, Lötters S, Van Der Meijden A, Menegon M, Müller S, Nagy ZT, Ofori-Boateng C, Ohler A, Papenfuss TJ, Rößler D, Sinsch U, Rödel M-O,l Veith M, Vindum J, Zassi-Boulou A-G, McGuire JA. 2019. Sexual Dichromatism Drives Diversification Within a Major Radiation of African Amphibians. Syst. Biol. 68: 859–875.

Reichert MS. 2013. Visual cues elicit courtship signals in a nocturnal anuran. Behav. Ecol. Sociobiol. 67: 265–271.

Robertson JM, Greene HW. 2017. Bright colour patterns as social signals in nocturnal frogs. Biol. J. Linn. Soc. Lond. 121: 849–857.

Rojas B. 2017. Behavioural, ecological, and evolutionary aspects of diversity in frog colour patterns. Biol. Rev. 92: 1059–1080.

Yovanovich CAM, Koskela SM, Nevala N, Kondrashev SL, Kelber A, Donner K. 2017. The dual rod system of amphibians supports colour discrimination at the absolute visual threshold. Philos. Trans. R. Soc. Lond. B. Biol. Sci. 372:20160066.

SUBMITTED BY:

PHILIPP BERG, Helpertseestraße 17, 63165 Mühlheim am Main, Germany.

E-mail: philipp.berg @ cantab.net

FRANCOIS S BECKER, National Museum of Namibia, P.O. Box 147, Windhoek, Namibia.

E-mail: phrogbecker @ gmail.com

CHAMAELEONIDAE

Chamaeleo dilepis
Leach, 1819
Common Flap-necked Chameleon

REFUGIA

S. DAVIDSON-PHILLIPS & J. SWART

On the 25th June 2013 at 09:28am**,** an adult Common Flap-necked Chameleon, *Chamaeleo dilepis* Leach, 1819 was observed in the Welgevonden Game Reserve (WGR), Limpopo Province, South Africa (24⁰ 22' 03.22'' S, 27⁰ 51' 45.36'' E) at an elevation of 1504 m. The recorded temperature from the WGR weather station located approximately 20 km away was 12°C. The chameleon was found inside an old dried dung bolus of an African Elephant, *Loxodonta africana* (Blumenbach 1797). The specimen was found while kicking into the dung and toppling the bolus (Fig. 1) during routine fire belt preparation.

The chameleon appeared to be in a state of dormancy with eyes initially closed. It was cold to the touch and dark coloured.(Fig. 2). Dormancy has been recorded in various reptilian species and is associated with lipid storage and use, most often through winter periods (Kenneth Derickson 1976; Price 2017). Dry season dormancy/aestivation is also a well-recognised phenomenon in chameleons (Longstaff and Poulton 1907; Loveridge 1954; Broadley and Blake 1979). There have been several anecdotal reports of Common Flap-necked Chameleons "brumating" (Mitchell 1946; Raw 1993; Alexander and Marais 2008), however, this may be the first recorded observation of a Common Flap-necked Chameleon making use of elephant dung to protect itself from environmental elements. WGR is located within two vegetation types namely the