



A Long-Lived Leucistic Cope’s Gray Treefrog (*Dryophytes chrysoscelis*) Tadpole from Northeastern Tennessee, USA

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The Gray Treefrog species complex (Hylidae) in North America comprises two morphologically similar species, Cope’s Gray Treefrog (*Dryophytes chrysoscelis*) and the Gray Treefrog (*D. versicolor*) (Dodd 2004; Holloway et al. 2006; Booker et al. 2021). The two species are typically differentiated by vocalization and karyotype, *D. chrysoscelis* being diploid (24 chromosomes) and *D. versicolor* being tetraploid (48 chromosomes) (Holloway et al. 2006; Niemiller and Reynolds 2011; Booker et al. 2021). The morphological similarity of the two species renders their geographic distributions difficult to discern and they often are referred to collectively as the

Gray Treefrog species complex in areas of sympatry (Dodd 2004). Only *D. chrysoscelis* has been recorded in northeastern Tennessee (Niemiller and Reynolds 2011), so we tentatively assign the subjects of this note to that species. However, the ranges of the two species in the complex overlap in nearby southwestern Virginia (Tobey 1985).

Leucism refers to abnormal coloration characterized by the partial or complete absence of all pigment in the body, although eyes retain their normal coloration, whereas albinism is the absence of melanin and affected animals typically have red eyes (Bechtel 1995; Allain et al. 2023). Both leucism



Figure 1. A leucistic larval Cope’s Gray Treefrog (*Dryophytes chrysoscelis*) from northeastern Tennessee, USA, exhibiting red tail coloration on 24 August 2021 (left) and without red coloration on 22 December 2021 (right). Photographs by Lance D. Jessee (left) and Jeremy B. Stout (right).

and albinism can be genetic, morphological, or immunological in origin (Henle et al. 2017; Hemnani et al. 2021; Chang et al. 2022) or can be caused by environmental factors such as chemical pollution (Jablonski et al. 2014; Henle et al. 2017). Although rarely observed in anurans in nature, a number of recent reports document leucism in both tadpoles (e.g., Smith 2014; Hughes et al. 2019; Hemnani et al. 2021; Szkudlarek et al. 2022) and adults (e.g., Hughes et al. 2019; Brown et al. 2020; Vallejos 2021; Szkudlarek et al. 2022; Allain et al. 2023).

Herein we report a leucistic larval *Dryophytes chrysoscelis* from Sullivan County, northeastern Tennessee, USA. On 8 August 2021, an unusually colored tadpole from an artificial garden pond at a private residence in Bristol, Tennessee, was reported to The Nature Center at Steele Creek Park. Its body was white and its eyes were black (Fig. 1), which we determined to be leucistic based on criteria outlined in Allain et al. (2023). The normal coloration of *D. chrysoscelis/versicolor* tadpoles varies, but is generally yellowish-brown to gray with a light venter and a translucent tail fin with dark blotches (Fig. 2) (Dodd 2004; Niemiller and Reynolds 2011). Only one tadpole in a group estimated at about two hundred was leucistic. Many of the tadpoles had already developed hindlimbs and an adult conspecific was observed at the site.

The leucistic tadpole and another with typical pigmentation were brought to The Nature Center at Steele Creek Park on 12 August 2021. They were kept in a 2.5-gallon glass aquarium with a small sponge filter. Care was based on Smith and Welch (2005), tadpoles were fed finely ground flaked fish food twice a week and dechlorinated water was changed weekly and sometimes twice weekly. The normally colored individual was already at Gosner stage 39–40 (Gosner 1960) at the time of arrival and had completed metamorphosis by

16 August. Many of the tadpoles in the garden pond also completed metamorphosis by the end of August.

The leucistic tadpole arrived lethargic and remained so until its death on 12 January 2022. It was observed eating regularly and, at the time of its death, weighed 398 mg and had a total length of 43 mm. Morphology comparable to Gosner stage 25 (Gosner 1960) with no indications of hindlimb development did not change during the 153 days it remained in our care. When it first arrived at the nature center, it exhibited red coloration of the tail (Fig. 1), which is a predator-induced response common to the species (McCollum and Van Buskirk 1996; Thibaudeau and Altig 2012; Altig and McDiarmid 2015), but lost the red coloration (Fig. 1) shortly after arrival.

In the single previous report of leucism in *D. chrysoscelis/versicolor*, Gibson et al. (2020) noted slower development (hindlimbs only) and odd behavior leading to death after 16 days in captivity. Other reports of leucistic tadpoles of various species also noted developmental problems. Mitchell and White (2005) and Smith (2014) noted slower development and a failure to metamorphose in two leucistic larval Wood Frogs (*Lithobates sylvaticus*). Krings and Reich (2016) noted a long developmental delay and presumed larval hibernation of a leucistic Common Frog (*Rana temporaria*) tadpole in Germany. Compared to typically pigmented individuals, Arietta et al. (2020) reported long developmental delays, failures to metamorphose, and high mortality rates in wild-caught leucistic Wood Frog tadpoles reared in a laboratory. Szkudlarek et al. (2022) reported leucistic European Green Toad (*Bufo viridis*) tadpoles that had issues freeing their forelimbs and resulted in death. Developmental anomalies associated with leucism in frogs have yet to be fully understood (Arietta et al. 2020).



Figure 2. A Gray Treefrog (*Dryophytes versicolor*) tadpole with typical coloration. Photograph by L. Kealoha Freidenburg.

Larval *D. chrysoscelis/versicolor* typically metamorphose in ~24–65 days after hatching during their first summer (Dodd 2004; Altig and McDiarmid 2015; Snyder et al. 2016), although McCallum and McCallum (2005) documented one instance of tadpoles overwintering in a permanent artificial pond in northwestern Louisiana. Overwintering could be the result of late-season oviposition, which has been reported for some overwintering tadpoles of other species (e.g., Gray et al. 2016). The individual described herein, however, likely was not the result of late-season oviposition and almost certainly exhibited developmental delays such as those described by Arietta et al. (2020). Although the overwintered tadpoles reported by McCallum and McCallum (2005) might have lived longer, to the best of our knowledge, at 153 days (minimum age), this is the longest-lived tadpole recorded for the *D. chrysoscelis/versicolor* species complex.

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