

Longevity and Extreme Ontogeny of Color Pattern in a Gonochoristic Texas Spotted Whiptail (*Aspidoscelis gularis gularis*)

Benjamin T. Camper, Department of Biology, Clemson University, Clemson, SC; bcamper@g.clemson.edu

Sharon A. Bewick, Department of Biology, Clemson University, Clemson, SC; sbewick@clemson.edu

Sam C. Godwin, Department of Biology, Clemson University, Clemson, SC; sgodwin273@gmail.com

Luis A. Garcia, Department of Wildlife & Fisheries Biology, Clemson, SC; lgarci5@g.clemson.edu

Riley T. Manuel, Department of Ecology and Evolutionary Biology, University of Michigan, Ann Arbor, MI; rtmanuel@umich.edu

James E. Cordes, Division of Arts and Sciences, Louisiana State University Eunice, Eunice, LA; jcordes@lsue.edu

James M. Walker, Department of Biological Sciences, University of Arkansas, Fayetteville, AR; jmwalker@uark.edu

In the lower Rio Grande Valley in the Texas border counties of Starr, Hidalgo, and Cameron, the gonochoristic Texas Spotted Whiptail (*Aspidoscelis gularis gularis*) is typically found in syntopy with either one or both clonal complexes of the diploid parthenogenetic Laredo Striped Whiptail (*Aspidoscelis laredoensis*). From hatchlings to adults, the identities of these species and clonal complexes are immediately recognizable to the trained eye based on distinctive color patterns (Walker 1987, Paulissen 2000). Recently, Cordes et al. (2022) reported that *A. laredoensis*, which is an essentially annual species in the long growing season in the lower Rio Grande Valley of Texas (Paulissen 2000), attains a ventral color pattern during an extended life in captivity that is typically not attained during the usual shorter life span in nature. The purpose of this report is to describe the color pattern of an unusually large female of *A. g. gularis* which had apparently escaped the vicissitudes of nature long enough to have attained a ventral color pattern that we had not previously seen in a wild-collected female of this taxon. Since 1983, two of us (JMW and JEC) have examined hundreds of wild-collected adults of *A. g. gularis* from Texas, New Mexico, and Oklahoma in the United States and from Coahuila, Nuevo León, and Tamaulipas in México. Throughout its geographic

distribution, the hallmark pattern traits in sexually mature males of *A. g. gularis* are numerous pale-hued spots on the dorsal aspect of the trunk, an unspotted red, orange, or pink throat, and an intense purple-blue thoracic suffusion which may encroach on aspects of the abdominal region and ventral surfaces of the forelimbs. Even under field conditions, many aspects of these pattern traits are usually apparent in males even from a distance of several meters, and they certainly would be visible to a female engaged in courtship. The image of the solitary lizard, which was photographed *in situ* in Mason County in central Texas (Fig. 1), was selected for comparison with the unusual wild-captured female described herein because it exemplifies the regal color pattern attained by an unusually large and aged male of *A. g. gularis* that had also defied the vicissitudes of nature. The following hallmarks of the ontogenetically modified pattern of the male of this taxon are quite



Fig. 1. A large aged male Texas Spotted Whiptail (*Aspidoscelis gularis gularis*) with a regal ontogenetically derived color pattern photographed by Dr. Harry W. Greene on 12 May 2023 at 0827 h at Rancho Cascabel, Fly Gap Road south of Pontotoc, Mason County, Texas. In particular, note the pattern of the lateral aspect of the trunk and colors of the thoracic region, under surfaces of forelimbs, and throat.

Throughout its geographic distribution, the hallmark pattern traits in sexually mature males of *A. g. gularis* are numerous pale-hued spots on the dorsal aspect of the trunk, an unspotted red, orange, or pink throat, and an intense purple-blue thoracic suffusion which may encroach on aspects of the abdominal region and ventral surfaces of the forelimbs.

visible in the image (Fig. 1). They include presence of a profusion of pale-hued spots above the level of the disrupted lateral stripes and some appear to be superimposed on the primary stripes, evidence that fragments of the disrupted lateral stripes had coalesced with pale-hued spots into irregularly shaped lateral bars, visibility of parts of the very dark-hued (i.e., almost black) suffusion of the thoracic region and encroachment of the suffusion onto the ventral surfaces of the forelimbs, a smudge of the dark coloration is also present on the gular fold, and part of the distinctive unspotted reddish hued throat coloration is also visible. Sexually mature females of *A. g. gularis* develop a throat coloration that is somewhat similar to that of males; however, the thoracic and abdominal regions typically do not develop the purple-blue suffusion. The only exception to this pattern arrangement observed in females of *A. g. gularis* has been in an occasional female maintained in a laboratory longer than the expected life span in nature (Fig. 2).

On 11 July 2023, a Clemson University research team consisting of BTC, SAB, SCG, LAG, and RTM trapped a remarkable individual of *A. g. gularis* in the recently accessed Milagro Tract, a small natural area in the Lower Rio Grande Valley National Wildlife Refuge in Texas. This tract is situated ca. 21.36 km east of the southeast corner of Bentsen-Rio Grande Valley State Park in Hidalgo County, Texas. It was accessed by vehicle from ca. 0.5 km east of the Pharr-Reynosa International Bridge. It stretches ca. 2.832 km along the Rio Grande (i.e., ca. 26.064836°N, -98.186389°W to 26.062238°N, -98.201706°W, WGS84, elev. ca. 28 m).

That the lizard featured in this report is a female of *A. g. gularis* (Fig. 3A-D) was indicated by the relatively small size of the femoral pores and absence of enlarged postanal = post cloacal scales (Fig. 3C) as described by Ashton (2003). Five of the coauthors were unable to detect evidence of hemipenes using a technique by Harolow (1996). Next, images of the cloacal region and ventral aspect of the base of the tail were e-mailed

to JMW. He enlarged the appropriate image and could find no evidence of large post cloacal scales as described for males of *Cnemidophorus* = *Aspidoscelis gularis* by Pietruszka (1981) and Ashton (2003). This female's snout-vent length (SVL) of 95 mm is the largest observed among all *A. g. gularis* and both *A. laredoensis* clonal complexes (*sensu* Walker 1987) captured from the lower Rio Grande Valley in May-August 2023. The individual is a minimum of 10 mm larger in SVL than any other female of *A. g. gularis* trapped during that period. When removed from the trap device at the Milagro Tract, the ventral pattern and overall morphology of the animal seemed to indicate that it was a male of *A. g. gularis*. However, when attempts by BTC, SAB, SCG, LAG, and RTM to evert the hemipenes by a proven method failed, various data and images were amassed before it was released. Seven images of this lizard were later e-mailed to JMW, of which four are included in Fig. 3A-D. We offer these images as primary examples of the ontogenetic pattern attributes that can develop with extreme age in a female of *A. g. gularis* in the lower Rio Grande Valley of Texas. The female had suffered tail breakage posterior to the 26th complete caudal scale whorl counting from the rump to the regenerated part of the tail. Both the scalation and color of the regenerated part of the tail were distinct from the original part, especially from a ventral perspective (Fig. 3C). The overall dorsal pattern is clearly that of an individual of *A. g. gularis* (Fig. 3A). Moreover, it has the plate-like postantibrachial scales of *A. g. gularis* (Fig. 3D). The dorsal ground color between the longitudinal stripes is brown-tan. Among the primary stripes the dorsal-most bilateral paravertebrals and middle dorsolaterals on each side were intact whereas the lower-most laterals on both sides had become slightly disrupted through formation of incipient lateral bars (Fig. 3A). The middorsal = vertebral configuration is band-like with distinct edges that suggest paired longitudinal stripes (Fig. 3A). Ventrally, the aspect of the pattern that is unusual for

On 11 July 2023, a Clemson University research team consisting of BTC, SAB, SCG, LAG, and RTM trapped a remarkable individual of *A. g. gularis* in the recently accessed Milagro tract, a small natural area in the Lower Rio Grande Valley National Wildlife Refuge in Texas.

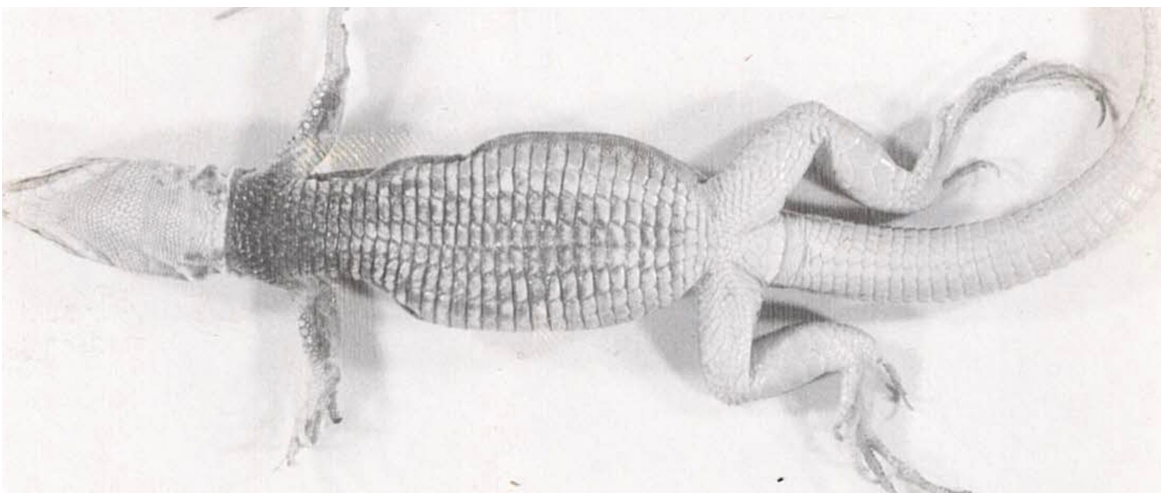


Fig 2. A scanned black and white polaroid image of an adult female Texas Spotted Whiptail (*Aspidoscelis gularis gularis*) captured on 9 May 1988 at Los Ebanos, Hidalgo County, Texas, and sacrificed 13 April 1989. It was of adult size at capture and was maintained in a laboratory for 339 days at the University of Arkansas, during which it attained this unusual ventral pattern for a female.

a female of *A. g. gularis* is the purple-blue suffusion on the thoracic and abdominal regions, although it is much less extensive and less intense in color than in males (Fig. 1 compared with Fig. 3B). Notably, and uncommonly observed in mature males, orange pigment speckles the purple-blue suffusion observed along the center of the venter from the pectoral region until the purple-blue suffusion ends posteriorly. Most females succumb to the vicissitudes of nature before they grow to the size and age to develop the purple-blue suffusion. Whether such a fate in individuals of *A. g. gularis* is a result of predation, disease, or senescence remains an open question.

Acknowledgements—The Clemson group was funded by National Science Foundation award #2105604 to SAB. Site access was allowed under USFWS permit LRGV-04-26-23-SAB held by BTC. Funding for JEC was provided by an Endowed Professorship through Louisiana State University Eunice Foundation and Opelousas General Hospital and supplemented by the J.M. Walker Family Trust. Harry W. Greene, Professor of Ecology and Evolutionary Biology (Emeritus), Cornell University, kindly allowed the use of Fig. 1.

Literature Cited

- Ashton, K.G. 2003. Sexing *Cnemidophorus* lizards using a postanal tail character. *Herpetological Review* 34:109-111.
- Cordes, J.E., J.M. Walker, M.A. Paulissen, R.C. Thomson, and A.J. Barley. 2022. Longevity and ontogeny of color pattern in diploid parthenogenetic *Aspidoscelis laredoensis* clonal complex in Texas. *Sonoran Herpetologist* 35:152-153.
- Harolow, P.S. 1996. A harmless technique for sexing hatchling lizards. *Herpetological Review* 27:71-72.
- Paulissen, M.A. 2000. Life history and drought tolerance of the parthenogenetic whiptail lizard *Cnemidophorus laredoensis* (Teiidae). *Herpetological Natural History* 4:41-57.
- Pietruszka, R.D. 1981. Use of scutellation for distinguishing sexes in bisexual species of *Cnemidophorus*. *Herpetologica* 37:244-249.
- Walker, J.M. 1987. Distribution and habitat of a new major clone of a parthenogenetic whiptail lizard (genus *Cnemidophorus*) in Texas and Mexico. *Texas Journal of Science* 39:313-334.

Notably, and uncommonly observed in mature males, orange pigment speckles the purple-blue suffusion observed along the center of the venter from the pectoral region until the purple-blue suffusion ends posteriorly.

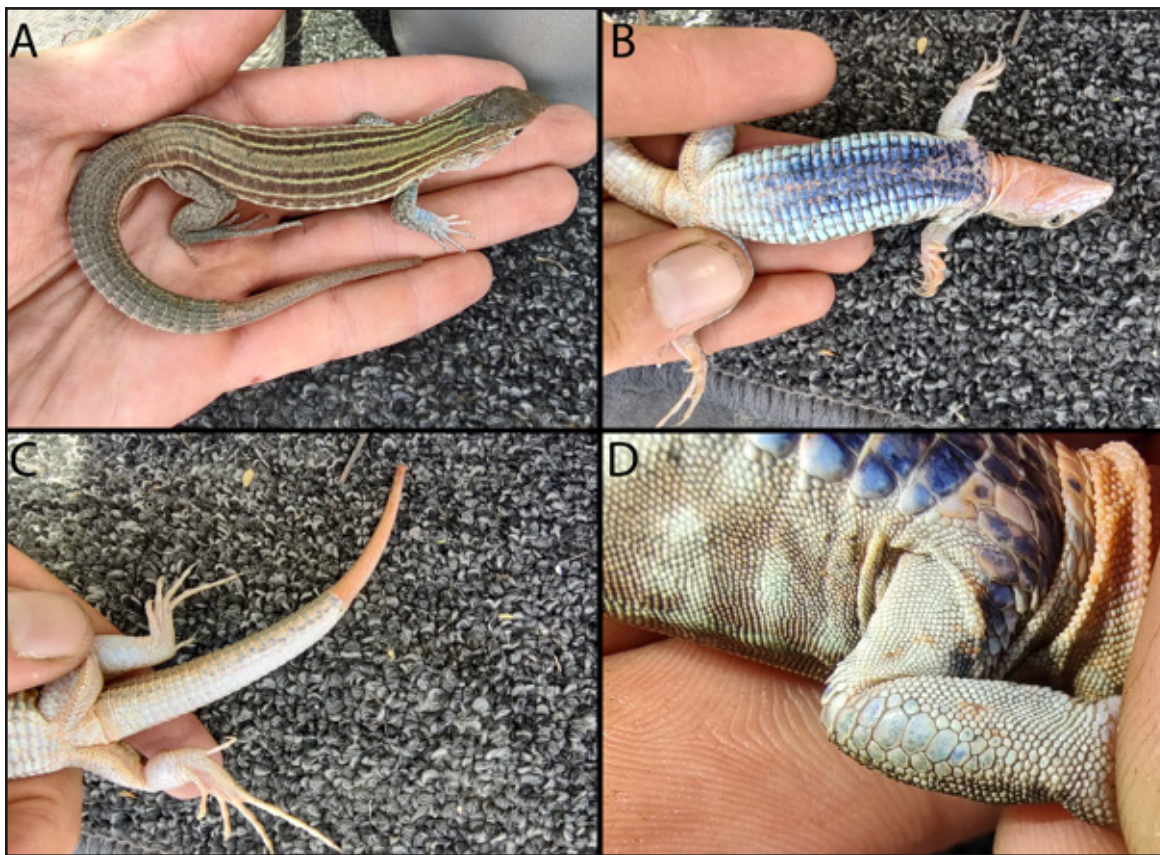


Fig. 3. Unusually large and aged female Texas Spotted Whiptail (*Aspidoscelis gularis gularis*) with a fully ontogenetically derived color pattern captured and released in July 2023 in Hidalgo County, Texas: **A)** retention of typical dorsal pattern, **B)** unusual ventral pattern for an adult female consisting of purple-blue suffusion on parts of thoracic and abdominal regions which does not include ventral surfaces of forelimbs, **C)** ventral aspect of posterior part of body showing relative size of femoral pores and post cloacal scalation on base of tail, and **D)** enlarged and plate-like postantibrachial scales.