OCCASIONAL PAPERS

Museum of Texas Tech University

NUMBER 164 15 MAY 1997

ABERRANT MORPHOLOGY IN WESTERN DIAMONDBACK RATTLESNAKES (*CROTALUS ATROX*)

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Although intraspecific variation in color is common among western diamondback rattlesnakes (*Crotalus atrox*), individuals typically exhibit brownish, diamond-shaped markings along the mid-dorsum. In addition, the tail is characterized by alternating black and white rings of approximately equal width (Klauber, 1972; Werler, 1978). These patterns make field identification of western diamondbacks rather easy. However, rare occurrences of atypically colored individuals have been reported. The descriptions of color abnormalities have ranged from albinistic to quasi-melanistic to patternless (Tennant, 1984).

We herein report two aberrantly patterned western diamondback rattlesnakes from the Rolling Plains of north-central Texas. One specimen, a juvenile female, was acquired from mesquite grassland in Weinert, Haskell County, Texas. The specimen (TTU-R 11495), which was collected in July, 1994, and tissues from the individual (TK 51079) are deposited in the of reptile and cryogenics collections, respectively, in the Natural Science Research Laboratory at the Museum of Texas Tech University. The other specimen, an adult female (TTU-R 7363), was discovered in the collection at Texas Tech. This individual also was acquired from Haskell County, although the specific site and date of collection are unknown. Based on catalog records of other reptiles, it was collected no later than 1974.

The two specimens are similar in color, both being plain, uniform, light brown with no obvious dorsal diamond pattern or facial markings. Upon close examination, the snakes appear to have a faint, medium light brown mid-dorsal stripe extending from just behind the head posteriorly towards the tail. The stripe is slightly darker than the ground color, and appears to be composed of tiny punctations of dark pigment. The tails of the snakes are mottled grayish brown or black on the sides with a solid black dorsal stripe. Alternating bands of black and white are absent. In the adult specimen, the longitudinal stripe is obvious the entire length of the body, terminating where it meets the black tail stripe. In the juvenile specimen, the longitudinal stripe is evident from the head down to about 80 percent the length of the body. It then nearly fades away before again becoming noticeable near the tail (Fig. 1).

This pattern appears to be the result of what Klauber (1972) termed blotch pattern transformation, whereby transverse blotches (diamond markings in this case) are transformed into longitudinal stripes. This phenomenon has been reported in several other species of rattlesnakes, including the Mojave rattlesnake (*C. scutulatus scutulatus*), the Tamaulipan rock rattlesnake (*C. lepidus morulus*), the Queretaran dusky rattlesnake (*C. triseriatus*), the red diamond rattlesnake (*C. ruber ruber*), the prairie rattlesnake (*C. viridis viridis*), the

Fig. 1. Aberrantly patterned juvenile western diamondback rattlesnake acquired from Haskell County, Texas. Faint longitudinal stripe appears to be the result of blotch pattern transformation. Snout to vent length of this specimen is 450 mm.

northern pacific rattlesnake (*C. v. oreganus*), the southern pacific rattlesnake (*C. v. helleri*), the Panamint rattlesnake (*C. mitchellii stephensi*) (Klauber, 1972), and the western massasauga (*Sistrurus catenatus tergiminus*) (Irwin, 1979). However, in aberrant individuals of these taxa, the longitudinal stripe only extends two-thirds the length of the body or less (Klauber, 1972; Irwin, 1979). Complete blotch transformation (longitudinal stripe from head to tail) in rattlesnakes formerly was known only on the basis of four individuals. One was a timber rattlesnake (*C. horridus*) reported by Gloyd (1935). Interestingly, the other three were western diamondbacks from Texas, one from Bexar County, one from adjacent Comal County, and the other from an unknown place in southeast Texas (Gloyd, 1958; Klauber, 1972). In addition, Tennant (1984) reported that in 1981 two "almost patternless cinnamon-gray" specimens were collected from the Williamson County area of Texas, which is near Bexar and Comal counties. Although this description is rather vague, it seems to resemble that of our specimens from Haskell County.

Whether or not these reports of aberrant diamondbacks are random, isolated occurrences remains to be determined. A considerable portion of the range of the western diamondback is in Texas (Smith and Brodie, 1982; Stebbins, 1985), so it may be coincidental that all seven reported specimens with this aberrant pattern were found in Texas. Furthermore, the Bexar-Comal-Williamson County area is nearly 300 km to the southeast of Haskell County. On the other hand, consider that two of the seven known specimens were discovered in the same county at least 20 years apart, and four of the remaining five specimens were acquired from areas of relatively close proximity over a span of at least 33 years. It is conceivable that this aberrant trait is being

maintained, albeit at low levels, in two central areas in Texas. In the California kingsnake (*Lampropeltis getula californiae*), a taxon in which pattern transformation is common, Klauber (1972) reported aggregations of aberrant forms in a central area within the range of that taxon. As the distance from this central area increased, fewer aberrant types were noted, until an area was reached where all snakes possessed normal patterns. This geographic pattern in aberrant individuals was so pronounced that, at one time, they were under consideration for separate subspecific status (Klauber, 1936). Additional acquisitions of aberrant western diamondbacks are required to understand further the geographic pattern of this phenomenon in that species.

Gloyd (1958) commented on the interesting situation whereby all three specimens he reported on were from the same general area in Texas, and that they were collected in different years by different collectors. However, due to a lack of data, he declined to speculate as to a genetic mechanism associated with this aberrant trait. Fitch (1959) noted a small aggregate of aberrant male copperheads (*Agkistrodon contortrix*) in Kansas, and hypothesized that a recessive sex-linked gene was responsible for maintaining the trait in the population by "expressing itself in the phenotype of the male because he has only one X chromosome, and lacks a dominant masking allele," (Fitch 1959: 24). However subsequent karyologic work by Baker et al. (1972) revealed the heterogametic sex in *A. contortrix* to be the female, thus all but disproving sex-linkage of a recessive patternless gene in that species. In *C. atrox*, the female also is the heterogametic gender, having a sex chromosome compliment of ZW (Baker et al., 1972). Interestingly, all five specimens of *C. atrox* verified to have the type of aberrant pattern described herein are females (the sexes of the two questionable specimens from the Williamson County area are unknown). Assuming a 1:1 ratio of males and females in the population, and an equal chance of being collected, it is improbable that observing five females and no males with this pattern is due to chance alone (based on the binomial distribution, $p = 0.03$). We suggest that in *C. atrox*, a recessive W-linked gene possibly is responsible for the type of blotch pattern transformation described in this report.

ACKNOWLEDGMENTS

We are grateful to Roger Conant and Norman J. Scott, Jr., for reviewing this manuscript.

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It was through the efforts of Horn Professor J Knox Jones, as director of Academic Publications, that Texas Tech University initiated several publications series including the Occasional Papers of the Museum. This and future editions in the series are a memorial to his dedication to excellence in academic publications. Professor Jones enjoyed editing scientific publications and served the scientific community as an editor for the Journal of Mammalogy, Evolution, The Texas Journal of Science, Occasional Papers of the Museum, and Special Publications of the Museum. It is with special fondness that we remember Dr. J Knox Jones.

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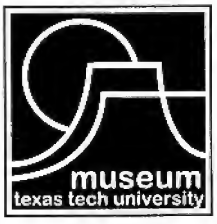

ISSN 0149-175X

Museum of Texas Tech University, Lubbock, TX 79409-3191