
The Development of Melanism in an Oklahoma Population of *Chrysemys scripta elegans* (Reptilia:Testudinidae)

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The radical melanic changes which occur in old males and some old females of turtles of the *Chrysemys scripta* (formerly *Pseudemys scripta*) group are well known and thoroughly documented. An especially lucid account of the development of the melanism is given by Barbour and Carr (1940). It has been suggested that the age at which the melanism first becomes apparent is geographically variable (Cagle, 1950; Webb, 1961), but information on the onset and development of melanism in populations from various parts of the species' range has been lacking. This brief analysis of melanism in an Oklahoma population of *Chrysemys scripta elegans* is offered as a contribution toward an understanding of possible geographic variation in this phenomenon.

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MATERIALS AND OBSERVATIONS

On 12 February 1957, 81 specimens of *Chrysemys scripta elegans* were taken from a hibernaculum in a service tunnel under the dam of Lake Carl Blackwell, west of Stillwater, Payne County, Oklahoma. The turtles were brought to the laboratory where they were measured and weighed, and their plastrons photographed. Sex was determined by sec-

ondary sexual characters (elongated claws on the forefeet and longer tails in males) and several of the smaller specimens were dissected for confirmation. Turtle size is expressed as plastral length in centimeters, to facilitate comparison with the work of Cagle (1950) and Webb (1961).

Data for both male and female turtles were divided into six plastral-length classes, as follows: class I, 10-11.9 cm; class II, 12-13.9 cm; class III, 14-15.9 cm; class IV, 16-17.9 cm; class V, 18-19.9 cm; and class VI 20 cm and larger. Among the 45 female turtles there were 8 (17.8%) in class I which averaged 11 cm; 14 (31.1%) class II, average 12.9 cm; 5 (11.1%) class III, average 14.9 cm; 6 (13.3%) class IV, average 16.6 cm; 8 (17.8%) class V, average 18.6 cm; and 4 (8.9%) class VI, average 21.9 cm. The smallest female measured 10.7 cm, the largest two both 23.5 cm. The 35 males comprised 10 (28.6%) class I specimens which averaged 11.2 cm; 6 (17.2%) class II, average 12.9 cm; 13 (37.2%) class III, average 14.9 cm; 4 (11.4%) class IV, average 16.9 cm; and 2 (5.7%) class V, average 18.8 cm. There were no male turtles over 20 cm plastral length (largest 18.8 cm), and one immature male measured 9.2 cm. From comparison with size-maturity data on a population of this species in southern Oklahoma (Webb, 1961), most of the females in size classes IV, V, and VI were sexually mature and most of the male sample had reached maturity.

Melanic changes in the bright pattern of subadult turtles appear first in the plastral scutes, with subsequent involvement of the carapace and skin of the legs, tail, and neck. This analysis is based only on the progress of melanic change in the plastral pattern, where the simple and contrasting juvenile pattern of ocellate black spots in the centers of the yellow scutes permits easy detection of melanin deposits and pattern changes. The first evidence of melanism is the deposition of a smudgy black spot in the center of each plastral scute, overlying and obscuring the juvenile ocellate spot (Carr, 1952: 252). All turtles in the sample had reached this stage, a convenient starting point for the further description of melanic changes.

Initially these plastral pigment spots, especially those on the posterior pairs of scutes, enlarge to form a continuous or almost continuous ring of black pigment around the plastron, which retains a yellow center and yellow edges. The spots of the posterior scutes usually join, while the anterior ones remain discrete (Fig. 1A). Most of the male turtles in size class I were beyond the stage of melanism, but a majority of the females in class I and some of those in class II were at this stage.

In the next stage of melanism the black pigment in the large, smudgy, and coalescent spots is withdrawn and redeposited at other points on the plastron. In both males and females, centers of melanin redeposition appear at the junctions of the pectoral-abdominal and abdominal-femoral sutures with the central suture. Secondary centers develop where the more anterior and posterior cross-sutures intersect the central suture. Pigment transfer continues until the sutural areas are broadly smudged with black, and the original central laminal spots are quite reduced, perhaps even light-centered (Fig. 1B). This stage was observed in some class I males (10.2 cm), persisted into class III (14.5 cm), and was apparent in some class IV females. From this point on, the development of melanism is different in males and females, and will be discussed separately.

In females the central plastral melanin deposits enlarge and expand in all directions, and eventually wash the entire plastron with black pigment, virtually obscuring all other markings. Concurrently with the development of a general blackening from the central area, large black smudges reappear near the positions of the original central laminal spots. Remnants of the original spots may be seen as faint ring-like edgings around these new spots. Advanced examples of this stage were found as early as class III (14.7 cm), and all females over 16.5 cm had the plastron

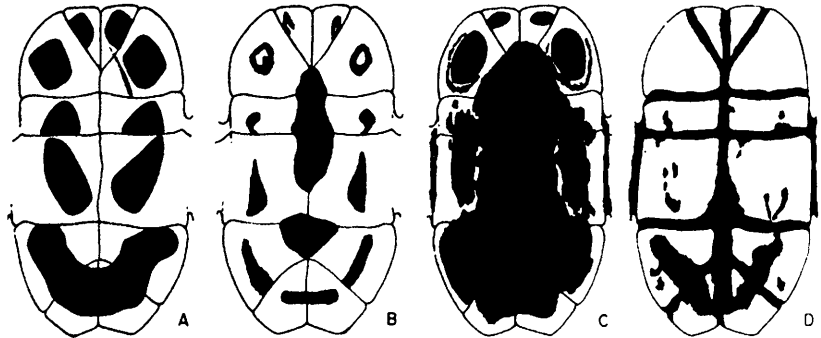


Figure 1. Diagrammatic drawings of plastrons of *Chrysemys scripta elegans*, illustrating stages in the development of melanism. A. initial stage in males and females; B. intermediate stage in males and females; C. advanced stage in females; D. advanced stage in males.

largely blackened. The black smudges in the centers of the scutes remain visible until finally obscured by the overwash of melanin. Webb (1961) reported that large females from Lake Texoma had plastrons 80% blackened. An advanced stage of melanism in a female turtle plastron is illustrated in Fig. 1C.

In males the transfer of pigment to the plastral sutures at the expense of the spots continues until the spots are completely lost, or only ring-shaped, and the pigment is mostly concentrated along the sutures. The centers of the scutes are yellow or slightly vermiculated with black, but both the juvenile ocelli and the melanic smudges overlying them are absent. The pigment along the sutures contracts and intensifies, forming sharp, black borders along the scutes (Fig. 1D). This definitive stage of melanism was seen in one class III male (14.5 cm) and was attained by all males in class IV and larger. Eventually a secondary wash of black may invest the plastron (Carr, 1952, pl. 47, p. 253) but this stage was not seen in the Oklahoma specimens.

DISCUSSION

In a review of the life history of *C. scripta elegans*, Cagle (1950) suggested that size at full attainment of melanism varies geographically, and presented data from turtle populations in Texas, Illinois, and Tennessee. Both Cahn (1937) and Webb (1961) have discussed the minimum size of fully melanistic turtles in other areas. Available records of minimum size of fully melanistic males are summarized in Table 1. Although this

TABLE 1. MINIMUM SIZE AT ATTAINMENT OF FULL MELANISM IN MALES FROM VARIOUS POPULATIONS OF *Chrysemys scripta elegans*, LOCALITIES ARRANGED FROM NORTH TO SOUTH.

locality	size (cm)	source
Illinois	15.2	Cahn, 1937
Illinois and Tennessee	13.0	Cagle, 1950
Lake Carl Blackwell, Okla.	14.5	this paper
Lake Texoma, Okla.	15.2	Webb, 1961
Texas	10	Cagle, 1950

function is obviously variable, no regular north-south trend is evident. This problem is further complicated by differences in individual workers' definitions of "full melanism", and perhaps also by geographic variation in the potential maximum extent of melanism. Cahn (1937) and also Barbour and Carr (1940) reported that in any given population, all males do not become melanistic, but at least part of them retain the premelanistic pattern. The limited observations of the turtles of Lake Carl Blackwell suggest that not only all of the adult males, but also all of the adult females, the latter contrary to the report of Carr (1952: 252), undergo extensive melanic changes. A similar situation has been reported in the population of Lake Texoma, Oklahoma (Webb, 1961) again raising the possibility of geographic variation in achieved melanism.

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