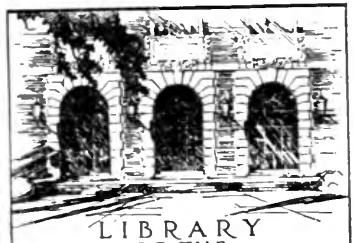

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THE WHITE SANDS EARLESS LIZARD

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Holbrookia maculata flavilenta Cope is a name that, for the past twenty years or so, has generally been associated with the peculiar, bleached population of earless lizards that inhabit the unique White Sands of southern New Mexico. This association has been incorrect, as the following discussion will demonstrate.

The White Sands *Holbrookia* has not been long known. In fact, as far as I am aware, the first mention of it was made by Ruthven, in 1907, who applied Cope's name of *flavilenta* and described in some detail the specimens he collected on the dunes. It is true that the history of the name *flavilenta* goes back much farther, and that many from elsewhere in New Mexico had been collected before 1907, but in spite of these facts Ruthven's specimens seem to have been the first known from the famous area about the dunes. No others were reported in the literature until 1942, with Bugbee's brief notes on the fauna of the area. This extraordinary paucity of published accounts does not necessarily imply a rarity of specimens—they are common enough on the dunes—or a general lack of knowledge of the existence of specimens. I have no doubt that after 1907 many more specimens found their way into various collections than published accounts would indicate. In fact, in 1931 I collected a series, the present location of which I unfortunately do not know, and a few collections I have examined contain others.

The responses of organisms to the extraordinary environment afforded by the White Sands have received the attention of many naturalists. In spite of the unique nature of the environment, however, relatively few endemic forms are known from there. Only two of the twenty mammals known are considered distinct (*Perognathus apache gypsi* Dice and *Geomys arenarius brevirostris* Hall). Among the reptiles only one, the earless lizard, has been

considered distinct. The evolutionary problems are discussed by Benson (1933).

Three species of lizards, exclusive of *Holbrookia maculata*, occur commonly on the dunes: *Uta stansburiana stejnegeri*, *Sceloporus undulatus consobrinus*, and *Cnemidophorus perplexus*. Specimens of any of these species from the dunes are lighter than those from the surrounding plains, yet the differences are perhaps not so marked as in the case of *Holbrookia*. Circumstances indicate that perhaps the lighter colors of the other lizards are directly affected not so much by genetic as by environmental factors. The dunes form of *Holbrookia*, however, appears to owe its lighter color to genetic changes, rather than to direct environmental effect, as Atsatt (1939) suggests. That this is the case is indicated by failure of the pattern and color to change under laboratory conditions; Dr. L. C. Stuart has informed me that specimens kept more than a year and observed under various environmental conditions did not change appreciably. I examined his experimental animals after they had been preserved, and certainly they were not different in appearance from specimens preserved when collected.

The distinctive features of the White Sands specimens are (1) great reduction in size and prominence of the dorsal blotches, and (2) absence of the brown pigment. The gray pigment is present or absent; when absent the lizard is uniform cream yellow above, and even under the microscope no pigment granules can be discerned. In its greatest concentration, in the darkest specimen examined (Field Museum No. 28571), the gray pigment is rather extensively distributed over the dorsal surfaces, but is absent in small scattered particularly prominent areas on the sides of the body; the mid-dorsal area may be more or less uniform light gray; on either side of the mid-dorsum are some ten small, faint, poorly defined, more or less crescentic blotches.

Normal specimens of the presumed parent race (*m. approximans*) possess fairly well-defined dorsal blotches, and are provided with brown as well as black (gray) pigment. In almost all races of *maculata* the dorsal blotches may be absent or reduced in a small percentage of specimens; but in none is this the usual condition, and in none, so far as I am aware, is the brown pigment absent even as an anomaly. From these statements it might be assumed that the White Sands specimens could be positively identified in all cases. I am not certain this is true, for probably intergradation in

these characters occurs in the territory surrounding the dunes, where *m. approximans* occurs.

That the marked color change in the White Sands *Holbrookia* is an adaptation to the specific conditions of that small area is a reasonable assumption. All facts bear out that assumption. As a corollary it may be assumed that the same genetic form is not to be expected elsewhere. Yet the type locality of *flavilenta*, the name usually applied to the White Sands race, is Lake Valley, Sierra County, about 175 miles west of the dunes. Cope (1883, p. 10) describes the locality: "It is in the foot-hills of the Mimbres or Negretta range. The region is rather arid, springs not being numerous; but during July and August there are frequent rains. Vegetation is abundant in the form of grass and herbaceous plants and shrubs." This is not a habitat like that of the White Sands. It is much more reasonable to assume that *flavilenta* is based merely upon the spotless variant that occurs normally, but infrequently, in *approximans* at any part of its range. As described, the cotypes cannot be distinguished from *approximans;* I have not examined them and do not know whether they are now extant.

Most of the references to *flavilenta* that have been included under that name are actually referable to

Holbrookia maculata approximans Baird

Holbrookia propinqua Cope, Proc. Acad. Nat. Sci. Phila., **1866**, p. 303—Navajo Springs; Fort Wingate; San Francisco Mountains; Colorado Chiquito River; Zuni City.

Holbrookia maculata propinqua Coues, Wheeler's Surv. W. 100th Mer., **5**, p. 601, 1875—New Mexico, Arizona.

Holbrookia maculata flavilenta Cope, Proc. Acad. Nat. Sci. Phila., **1883**, pp. 10–11—orig. description; type locality Lake Valley, New Mexico; Stejneger, N. Amer. Fauna, **3**, pp. 109–110, 1890—western New Mexico; Arizona, except extreme southern portion; Moencopie and Little Colorado River, Painted Desert, Arizona; Cope, Ann. Rept. U. S. Nat. Mus., **1898**, p. 298, fig. 34, 1900—copy of original description; Stone, Proc. Acad. Nat. Sci. Phila., **1911**, p. 225—greasewood belt east of Alamogordo, New Mexico.

Authors who have seen or dealt specifically with specimens of *maculata* from the White Sands have considered them distinct from those of adjacent areas. Van Denburgh, I believe, had not seen specimens. This synonymy has been placed under the new subspecies here described.

Since Ruthven was the first to discover the White Sands race and to realize its distinctness, and has given more pertinent notes

on it than any other authority, it is appropriate that the race from that locality be known as

Holbrookia maculata ruthveni subsp. nov.

Holbrookia maculata flavilenta Ruthven, Bull. Amer. Mus. Nat. Hist., **23**, pp. 523–525, 1907—color, habitat, food; Schmidt, Bull. Amer. Mus. Nat. Hist., **46**, pp. 720–721, 1922—taxonomic notes; Atsatt, Publ. Biol. Sci. Univ. Calif. Los Angeles, **1**, p. 253, 1939—comment upon color; subspecific name misspelled *flavienta*.

Holbrookia maculata approximans Van Denburgh, Proc. Calif. Acad. Sci., (4), **13**, pp. 202–203, 1924—all New Mexico records for *maculata* subspecies referred to *approximans*.

Holbrookia maculata subsp. Bugbee, Trans. Kans. Acad. Sci., **45**, pp. 316, 317, 1942—brief notes on habits.

Type from White Sands, about twelve miles southwest of Alamogordo, New Mexico. No. 29452 Field Museum of Natural History. Female. Collected May 26, 1938, by Wilfred H. Osgood.

Paratypes.—Ten, including F.M.N.H. Nos. 28571, 29450–29451, same collector and date; U.M.M.Z. No. 64690, collected by S. C. Whitlock, July 10, 1927; A.M.N.H. Nos. 334–339, collected by Alexander Ruthven, A. F. Zimmer, and G. von Krockow, July 9 and 19, 1906; and A.M.N.H. No. 61764, collected by J. E. Hill, October, 1938.

Description of type.—Two rows of scales between occipital and the one or two rows of granules surrounding the supraocular area, except at one point, where two adjacent scales are fused; frontal scales irregular, a pair of median scales bordered anteriorly and posteriorly by an azygous scale; internasals in about three rows; four scales bordering rostral behind, between anterior supralabials; two large canthals; no subnasal; four loreal rows, one scale in upper row, two rows between anterior canthal and supralabials; enlarged supralabials in contact with subocular posteriorly; supralabials low, elongate, overlapping about half their length. Dorsal scales small, smooth, convex; lateral scales smaller, somewhat protruding; ventral scales smooth, flat; scales on dorsal surfaces of limbs smooth; only distal caudal scales keeled. Femoral pores 10–10.

Snout to vent, 49.5 mm.; tail 41 mm.

The dorsal color, which seems to be well preserved, is a light, grayish cream, more yellowish on the sides. Extremely faint light spots, covering some eight to ten granules, are barely visible in the dorsolateral region; the mid-dorsal area of body, tail, and dorsal surfaces of limbs are perfectly uniform. Under the microscope no

pigment granules are discernible except on the sides of the belly, where on each side two small, black spots are formed by a concentration of dark pigment granules; a point halfway between axilla and groin is between the two dark spots; the anterior spot is slightly posterior to the elbow.

Variation.—The darkest paratype examined (No. 28571) was described briefly above. The lateroventral spots are large and distinct. This is a relatively large male with a broken tail, measuring 53 mm. snout to vent. The other paratypes have varying amounts of pigment between these two extremes.

Ruthven describes the color in life of his specimens as follows:

"In one specimen the color of the dorsal surface is uniformly grayish white, except for faint traces of dusky on the hind limbs, sides of head, and base of tail, and numerous faint spots of orange yellow that at a distance give a slightly pinkish appearance to the body. The head is light golden yellow above. There is a faint pinkish line extending from the outer canthus along the sides of the body and base of the tail, and another from the angle of the mouth to the groin, which is continued along the inner and outer sides of the thigh and base of tail. Belly creamy white, immaculate.

"Two other specimens are almost identical in color with the last, except that the dusky markings on the back are slightly increased in amount, making the orange spots somewhat more distinct. In [one] the upper surface of the head is also marked with darker.

"Three others, while also very pallid, are a little darker than those described above. In the darkest individual the ground color is light gray, with numerous small dark spots interspersed with orange-colored ones; the dark spots distinct or obscure but without definite arrangement. The amount of dark pigment is greatest on the upper surface of the limbs and tail. The color of the head is light golden yellow, that of the under surfaces the same as in the other two specimens. The pinkish lateral line is not discernible."

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