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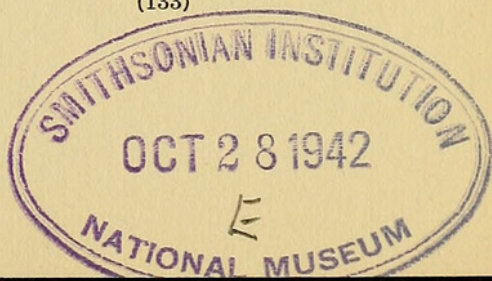
STUDIES OF THE RAT SNAKE, *ELAPHE LAETA*, WITH
DESCRIPTION OF A NEW SUBSPECIES.

BY ANGUS M. WOODBURY AND DIXON M. WOODBURY.

Ever since Baird and Girard described the first known specimen of this species from Red River, Arkansas, in 1853 (Cat. North American Reptiles, Part I, p. 77) gathering of additional specimens has been very slow and information exceedingly meager. Collection of specimens from the Colorado River Basin in Utah and Colorado, effectively separated by the Rocky Mountains from its previously known range stimulated the investigations on which this paper is based. In connection with the present study specimens were borrowed from the U. S. National Museum, Chicago Academy of Sciences, Field Museum of Natural History, University of California at Los Angeles, University of Texas, Baylor University, University of Nebraska, A. J. Kirn and Stanley Mulaik, to all of whom the writers wish to express sincere thanks.

If there is any interbreeding connection between the two contingents of the population, it would be expected to occur either through the South Pass break in the Rocky Mountains in central Wyoming or in northwestern New Mexico, where the continental divide dips so low that it is covered by the pigmy conifer forests of Juniper and Pinon, commonly regarded as belonging to the Upper Sonoran Life Zone. The South Pass in Wyoming is considerably higher, probably in the Transition Zone.

Specimens from the Colorado Basin, so far as known, come from the valleys or canyons along the Colorado and Green rivers in streamside habitats of trees or irrigated fields. A specimen from northern New Mexico was found in a ponderosa pine-boxelder forest. If this is indicative that they are more or less restricted to the vicinity of such watered areas in an otherwise semiarid region, then they are probably more isolated than previously indicated and there may be no regular channel of interbreeding with the more widespread and probably greater numbers of the contingent beyond the mountains.



The senior writer examined the lowest point of the continental divide in northwestern New Mexico in an effort to find a suitable habitat that might serve as an interbreeding channel between the San Juan and the Rio Grande drainages. Unless the snakes are able to leave the streamside forests and take to the open valleys, the pigmy conifers or mountain brush at higher altitudes, it is not likely that any interbreeding channel exists, in which case, it is probable that interbreeding, if any, is only intermittent and accidental. With such effective isolation of the Colorado Basin contingent, geographic variation might be expected.

In all, a total of 31 snakes were examined. Eight were from the Colorado Basin, of which 4 were from Moab, Utah, and 4 from Mesa and Garfield counties in Colorado. Of the balance, two were from New Mexico, 18 from Texas, 2 from Kansas and one from Nebraska. The principal significant characters revealed by this study are summarized in Table I. The tabulation seems to indicate that the greatest extremes of diversification lie in the Colorado Basin and in Central and southern Texas. Specimens from New Mexico, Kansas and Nebraska seem in general to be more or less intermediate.

The characters elucidated in the table indicate varying degrees and directions of divergence between the two contingents. Some characters not shown in the summary are practically uniform in all specimens. The anals were always divided (2). In all cases, there was one loreal, one preocular and 2 postoculars on each side. The upper labials were almost uniformly 8 in number on each side but there were exceptions in both populations. The lower labials were more variable. They ranged from 11 to 13 in the specimens from the Colorado Basin and 12 to 14 in those from Texas.

The scale formulas tend to run a little higher in the Texas specimens where a few had 27 on the neck, 29 on mid-body and a majority had 21 at the anus, as contrasted with the usual 25-27-19 in the Utah and Colorado specimens. The numbers of ventral plates indicated considerable divergence. The Texas specimens are again higher. In the Utah and Colorado specimens the range of abdominals is 203-215 with average of 209 and caudals of 63-69 with average of 67, as contrasted with the Texas specimens which have a range in abdominals of 213-234 with average of 223 and caudals of 60-80 with average of 73.

TABLE 1.—SUMMARY OF CHARACTERS.

Locality	Serial Number	Sex	Length Total-Tail	Scale Formula	Ventrals		Labials		Dorsal Blotches		Abd.— Blotch
					Body-Tail	Tot.	Upper	Lower	Body-Tail	Tot.	
Moab, Utah	UU 270	♂	845-160	25-27-19	211-69	282	8-9	12-13	48-19	67	59-82
Moab, Utah	UU 271	♂	875-160	25-27-19	203-68	271	8-8	12-13	43-18	61	50-92
Moab, Utah	CAS 3760	♀	658-112	25-27-21	214-67	281	8-8	11-11	52-22	74	56-73
Moab, Utah	CAS 4691	♀	838-140	25-27-21	215-63	278	8-8	11-11	55-22	77	60-70
Lacey, Colo.	FMNH 38225	♀	810-140	25-27-19	207-67	274	8-8	12-12	44-18	62	81-113
Lacey, Colo.	FMNH 38226	♂	885-110?	25-27-19	203-68?	271	8-8	12-12	44-18	60	60
Grand Junction	FMNH 1134	♂	947-166	25-27-19	207-66	273	8-8	12-12	48	73	159
Mesa, Colo.	FMNH 26879	♂	450-82	25-27-19	208-67	275	8-8	11-11	50-23	73	44-76
Averages					209-67	275½			48-20	69	58½-84
Superior, Neb.	U NEB 305	♂	940-165	25-27-19	213-73	286	8-8	11-12	50-20	70	163
Mankato, Kansas	USNM 90615	♂	345-60	27-27-21	209-67	276	8-8	11-12	46-16	62	163
Mankato, Kansas	USNM 90616	♂	559-72	27-27-19	223-65?	288	8-8	13-13	45-15	60	178
Rito Fyolís, NM	UCLA 198	♂	447-80	25-27-21	214-67	281	8-8	11-11	53-22	75	40-57
Las Cruces, NM	USNM 22138	♂	849-152	27-27-21	212-66	278	8-8	11-11	40-19	59	52-91
Frijole, Texas	Mosauer		980-155	27	213-63	276			52-18	70	161
Red River, Ark.	Type			29	227-77	304					
Texas											
Floresville	UU 2602	♀	1132-177	27-29-21	227-60	287	9-9	12-12	29-11	40	61-94
Somersett	UU 2601	♂	1200-220	25-27-19	217-77	294	8-8	13-13	36-15	51	32-34
Christoval	BU 6583a	♀	461-76	25-27-21	227-72	299	8-8	13-13	29-8	37	47-24
Christoval	BU 6583b	♀	460-78	27-29-21	230-75	305	8-8	14-14	31-12	43	36-38
Mercedes	BU 6355	♂	485-88	25-29-21	232-80	312	8-8	12-12	38-17	55	39-42
Van Ormy	UU 2604	♂	406-73	27-29-21	228-77	305	8-8	13-13	29-12	41	38-32
Lytle	UU 2496	♀	347-59	25-27-21	223-67	290	8-8	12-12	34-14	48	32-45
Lytle	UU 2498	♂	431-78	25-27-21	215-70	285	9-9	13-13	33-12	45	77-64
Lytle	UU 2497	♀	328-56	25-27-21	234-73	307	8-8	13-13	25-12	37	42-36
Lytle	UU 2500	♂	1118-205	25-27-19	224-78?	302	8-8	12-12	45-20	65	51-94
Lytle	UU 2495	♂	1112-210	25-27-21	218-78	296	8-8	13-13	39-17	56	49-62
Castroville	UU 2603	♂	980-188	25-27-21	217-76	293	8-8	13-13	39-17	56	57-98
Pecos River	USNM 4965	♀	985-177	25-27-21	215-73	288	8-8	13-13	42-18	60	38-60
Strong City	USNM 3829	♂	870-142	27-27-21	219-63	282	8-8	12-12	42-18	60	37-53
Austin	U. Texas	♂	1130-218	25-29-21	213-77	290	8-8	14-14	38-20	58	58-85
Edinburg	Mulaik	♀	960-166	25-27-19	220-66	286	8-8	13-13	37-15	52	46-71
Edinburg	Mulaik	♀	370-68	25-29-21	227-69	296	8-8	12-13	33-13	46	40-48
Edinburg	Mulaik	♂	353-68	25-27-19	221-78	299	8-8	12-12	36-18	54	58-66
Averages					223-73	295			35-15	50	46-58

? Tail incomplete, number estimated.

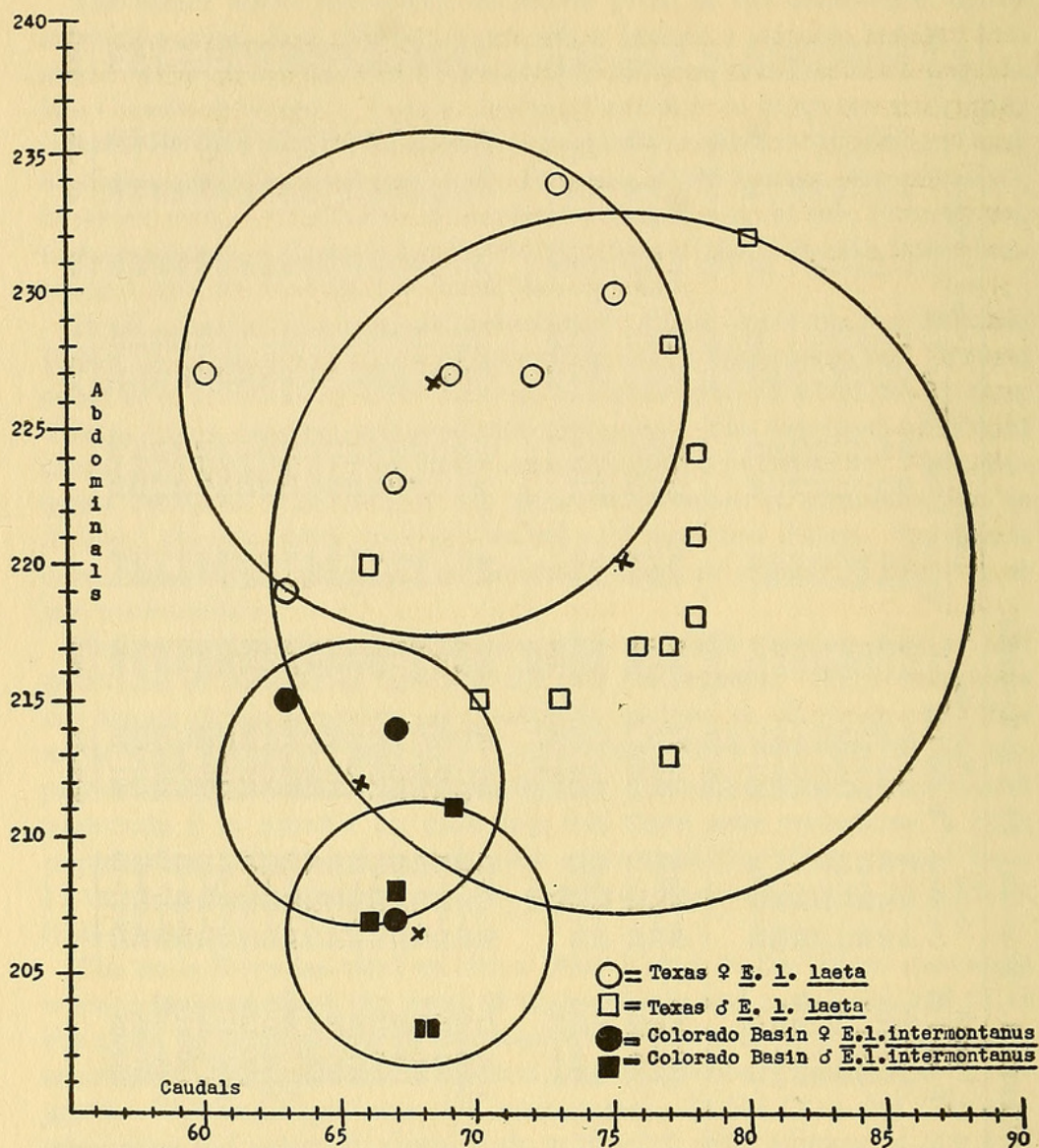


Fig. 1—Scatter graph arranged to show distribution of ventral plates; abdominals plotted against caudals. Circles show for each sex the Texas and Colorado Basin specimens separately.

The dorsal blotches indicated still further divergence, but in a reverse direction. The Texas specimens were generally lower in number. They had a range of 25–45 with average of 35 on the body and 8–20 with average of 15 on the tail. The isolated contingent had a range of 43–55 with average of 48 on the body and 18–23 with average of 20 on the tail.

These variations in blotch numbers produced some distortion in relation of blotch size to the interspaces between them. When measured and averaged, it was found that the greater number of blotches in the Colorado Basin forms had been produced by decreasing the average size of the blotches, without any significant decrease in width of the interspaces. This yielded a significant difference which was indicated by a much higher ratio of interspace to blotch. This is corroborated by scale counts. The

interspaces in both contingents are about $1\frac{1}{2}$ to 2 scales in length. The blotches of the Texas population are about 3 to 5 scales long with average approximately 4, whereas, the blotches on the Colorado Basin specimens are only about 2 to 4 scales long with average of 3.

These divergences of characters both in degree and direction seemed sufficient to warrant separation taxonomically. This was further tested on a single important character, the ventral plates by a scatter graph shown in figure 1. Specimens were plotted on the graph with abdominals against caudals. In order to compensate for sexual differences, each sex was plotted separately. For each sex in each geographic region, a circle was drawn using the average as center and extreme as the circumference. The females showed no overlapping but the males showed a small amount. The results showed significant divergences in the two geographic areas.

The most divergent characters, i. e., the ventral plates, the dorsal blotches and the ratio of length of interspaces to blotches were studied in more detail, sexes separately. The results are tabulated in table 2 and graphed in figure 2. The averages and ranges of each character for each sex in each of the two geographic localities are shown in the table and the averages are compared in the graph. It should be noted that in general much more divergences occur on the body and less on the tail.

TABLE 2—AVERAGES AND RANGES OF CHARACTERS.
VENTRAL PLATES.

Specimens	No. of specimens	Ventral Plates					
		Body		Tail		Total	
		Ave.	Range	Ave.	Range	Ave.	Range
Males:							
<i>E. l. laeta</i>	11	220	213-232	75.5	66-80	295.5	285-312
<i>E. l. intermontanus</i>	5	207	203-213	67.5	66-69	274.4	271-282
Females:							
<i>E. l. laeta</i>	7	228	219-234	68.4	60-75	295	282-307
<i>E. l. intermontanus</i>	3	212	207-215	65.7	63-67	277.7	274-281

DORSAL BLOTCHES.

Specimens	No. of spec- imens	Dorsal Blotches					
		Body		Tail		Total	
		Ave.	Range	Ave.	Range	Ave.	Range
Males:							
<i>E. l. laeta</i>	11	37.5	29-45	16.5	12-20	54	41-65
<i>E. l. intermontanus</i>	5	46.4	42-50	20*	18-23	66.7*	60-73
Females:							
<i>E. l. laeta</i>	7	31.9	25-42	12.4	8-18	44.3	37-60
<i>E. l. intermontanus</i>	3	50.3	44-55	20.7	18-22	71	62-77

RATIOS.

Specimens	No. of specimens	Ratio in % of interspaces to blotches					
		Body		Tail		Total	
		Ave.	Range	Ave.	Range	Ave.	Range
Males:							
<i>E. l. laeta</i>	11	49	32-77	64.3	32-98	113.5	66-155
<i>E. l. intermontanus</i>	4	53	44-60	83.3*	76-92	134.3*	120-142
Females:							
<i>E. l. laeta</i>	7	42	32-61	48.4	24-94	90.4	71-155
<i>E. l. intermontanus</i>	3	66	56-81	85.4	70-114	151	129-194

* Based on three specimens.

ELAPHE LAETA.

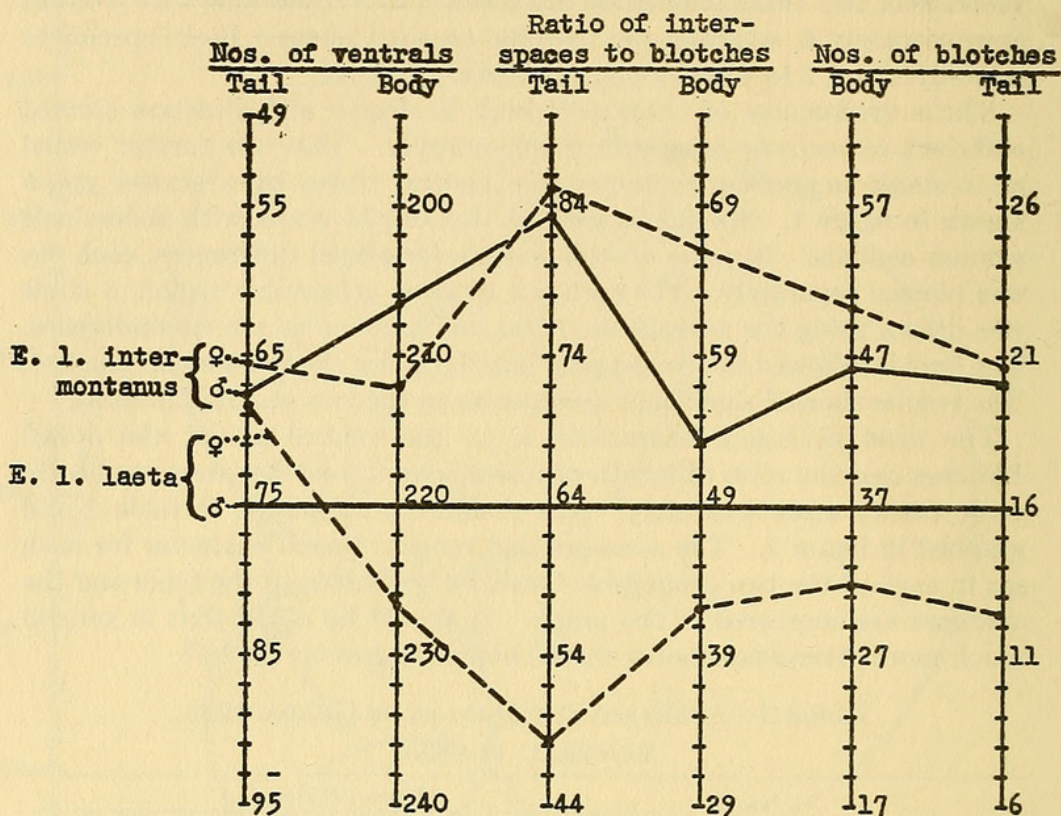


Fig. 2. Summary of selected characters showing differentiation of Colorado Basin Characters from those of Texas, using the means of the Texas males as the standard of comparison.

The averages indicate distinct divergences between the two populations in both sexes for each character, whether considered separately for body and tail or for total. The ranges of characters indicate little or no overlapping in each sex in the two areas as far as the body characters are concerned, but there is considerable overlapping in the characters on the tail and in the total.

A combination of certain characters offers a relatively good basis for separating the two populations. Since the dorsal blotches and the ventral plates diverge in opposite directions, the former being lower and the latter higher in the Texas specimens, a combination of the two presents a useful key character. Subtracting the number of dorsal blotches on the body not including the tail from the number of abdominal plates yields numbers that are less than 166 in the Colorado Basin specimens and more than 172 in those from Texas.

By comparing the specimens tabulated from Nebraska, Kansas, and New Mexico, it becomes evident that most of them are intermediates. The specimens from northern New Mexico, southern Nebraska and one of those from Mankato, Kansas, all seem to show affinities with the Colorado Basin forms and indicate interbreeding influence. The other specimens

from New Mexico and Mankato, Kansas, show more definite affinities with the Texas group. The data given by Baird and Girard in their original description, indicate that the type specimen also belongs with the Texas race.

Since the type is con-specific with the Texas population, it must of necessity be considered as the typical subspecies. In order to distinguish the two subspecies, description of both races based upon available specimens will be given.

The members of these two races may be separated from each other except in the areas of intergradation by the following:

KEY TO THE SUBSPECIES OF *Elaphe laeta*.

Dorsal blotches 3-5 scales long; ventrals under body and tail more than 282; abdominals minus body dorsal blotches more than 170.

Emory's Rat Snake.....*E. l. laeta*

Dorsal blotches 2-4 scales long; ventrals under body and tail less than 282; abdominals minus body dorsal blotches less than 170.

Intermountain Rat Snake.....*E. l. intermontanus*

In the region of intergradation in southern Nebraska and northern Kansas, members might fall in both subspecies according to this key, but it could hardly be maintained that both subspecies occurred in the same interbreeding population. We designate the specimens as intergrades, thus *E. l. laeta* \pm *intermontanus* but nearest *laeta* in the population characteristics despite the fact that some individuals may be reversed.

Elaphe laeta laeta (B and G)

EMORY'S RAT SNAKE.

Description.—Adult specimens often reach 1000-1200 mm. in length. Neck slightly constricted, body usually deeper than wide, flattened ventrally. A series of dorsal blotches traverses the back, usually about 35 in number (25 to 45) on the body and 15 (8 to 20) on the tail. These blotches are about 4 scales in length (3 to 5, occasionally 6 or 7) are of a dark brown color and bordered by darker brown or black. The interspaces about $1\frac{1}{2}$ to 2 scales in length are slightly lighter brown in color. The blotches alternate with smaller lateral rounded blotches on the side which in turn alternate with still smaller blotches (often nearly obsolete) ventrolaterally just above the ventrals.

The ventral ground color is white or creamy and there are two squarish brown blotches on many of the ventral plates. These tend to form 4 longitudinal rows on the body and two on the anterior tail but there are some irregularities produced largely by occasional plates on which the blotches are missing. The throat is generally without blotches.

The scale formula ranges from 25-27-19 through 25-27-21 to 27-29-21. The abdominal plates vary in number from 213 to 234, the caudals from 60 to 80 and the total ventrals from 282 to 312. The upper labials are usually 8 in number but there are occasionally 9. The lower labials range from 12 to 14.

Range.—This subspecies is presumed to range east of the Rocky Mountains from southern Nebraska south through Texas to central Mexico and from New Mexico to Arkansas and Missouri.

The new subspecies from the Colorado Basin may be known as

***Elaphe laeta intermontanus*, new subspecies.**

INTERMOUNTAIN RAT SNAKE.

Types.—Holotype, adult male, University of Utah Museum of Zoology (UU) No. 271, taken May 6, 1933, at Moab, Utah, by D. M. Parriott and preserved by A. M. Woodbury. Allotype, adult female, Chicago Academy of Science (CAS) No. 4691, taken May, 1938, at Moab, Utah, by D. M. Parriott and presented to Howard K. Gloyd. Paratypes: adult male, UU 270 taken at same time and place as holotype; young female CAS No. 3760 taken June, 1937, at Moab, Utah; adult male and female, Field Museum of Natural History (FMNH) Nos. 38225 and 38226 taken at Lacey, Garfield County, Colorado, August 13, 1941; adult male, FMNH No. 1134 taken at Grand Junction, Mesa County, Colorado; and a young male FMNH No. 26879 taken at Mesa, Mesa County, Colorado, July 18, 1927.

Type locality.—Parriott Ranch at a spring at foot of a sandstone ridge about two miles southeast of the Colorado River bridge and about one mile north of Moab, Grand County, Utah.

Diagnosis.—A grayer smaller race, usually less than 1000 mm. in length with reduced scalation numbers and increased pattern blotches.

E. l. intermontanus has a grayish tinge (in alcohol) to the dorsal background which appears to be absent from the brown background of *laeta*. In the ventral color pattern, plates without spots are numerous enough to be conspicuous in the Texas specimens but are rare in those from the Colorado Basin, which appear more densely spotted.

Fig. 2 analyzes the average divergences of certain characters in each sex between *laeta* and *intermontanus* on the basis of specimens from Texas and the Colorado Basin. *E. l. intermontanus* has fewer ventral plates but more and shorter dorsal blotches. In addition, the average scalation is lower wherever variable: i. e. in scale formula, lower labials, and ventrals.

Description of holotype. Total length 875 mm., tail length 160 mm.; body subcylindric deeper than wide, flattened ventrally; neck slightly constricted, tail tapering. The back is crossed by 43 dorsal blotches. Color in alcohol: the dorsal background is a light grayish brown (mauve taupe 7C8¹). The transverse dorsal blotches are but slightly darker brown (chicle 7C9 or 7C10) but are edged or outlined by a dark brown or blackish ring. These dorsal blotches alternate with lateral large rounded brown spots of similar color and similar dark edges lying along the sides. These spots in turn alternate with smaller spots (one or two) of similar color lying just above the edge of the ventrals, many of which are nearly obsolete.

The dorsal blotch of the neck, instead of being transverse, runs forward and parts in the middle on the back of the head, widens to the parietals

¹ All colors are referred to plates in the color dictionary, Maerz and Paul, McGraw Hill Co., 1930.

and then converges to rejoin on the frontal. A dark or dark bordered stripe runs forward along each side of the head, across the posterior upper labials, temporals and postoculars to the eye, thence over the edges of the posterior part of the prefrontals and tip of the frontal (nearly obsolete) to join in the middle. A stripe of lighter color separates these two dark stripes, crossing some temporals, edge of parietal, supraocular and frontal. A similar light stripe beginning on the upper labials, runs up in front of the eye and over the head involving the preocular, loreal and anterior parts of the prefrontals.

The ventral ground color is white or creamy (9C1 or 2) and is distinctly spotted, usually two squarish spots on a plate, some with a spot at each end, others with two spots near the middle, giving the appearance of four rows, mostly on alternate plates, except on the tail where the plates are divided, a single blotch tends to occur on each plate, and gives the appearance of two rows under the tail, the blotches occurring on nearly every plate.

Scalation: scale formula 25-27-19; abdominal plates 203, caudal plates 2 rows of 68, total ventrals 271; anal divided; head—rostral wider than high, in contact with first upper labials, prenasals and internasals; upper labials 8-8, lower labials 12-13; internasals in contact with pre- and post nasals and prefrontals; loreal trapezoidal, in contact with 2 and 3 upper labials, postnasals, preocular and prefrontals; upper labials 4, 5, and 6 enter eye ring; frontal widest in front where it corners on preoculars and wedges between parietals behind; first lower labials in contact behind mental; first pair of genials contact 1 and 2 labials anteriorly, 3, 4 and 5 laterally, each other centrally, 2nd pair of genials and a pair of small gular scales posteriorly; 2nd pair of genials in contact with lower labials 7 and 8, and separated by 2 pairs of small gular scales.

Variation of types. The color pattern is much more distinct in the allotype and all the paratypes except FMNH 1134 which is considerably less distinct. This suggests that the color pattern tends to become obsolete in old specimens. The dorsal blotches range in number on the body from 42 to 50 in males and 44 to 55 in females and on the entire snake from 60 to 73 in males and 62 to 77 in females. In longitudinal length along the snake, blotches are longer than interspaces, the latter varying on the body from 44 to 60% in males and 56 to 81% in females. There is considerable variation in the details of color patterns in various specimens.

The scale formula in six specimens is 25-27-21. The abdominal plates range from 203 to 215 and the caudals from 63 to 69. The upper labials are 8 with one exception of 9. The lower labials range from 11-11 to 12-13. Minor detailed variations occur in the arrangement of gulars around the genials.

The shape of the body cross-section varies somewhat, possibly with age, the younger or smaller specimens tending toward cylindrical or circular ventrally flattened and the older or larger specimens tending to stand up higher, being deeper than wide and with similar ventral flattening.

Specimens. In addition to the types examined, a specimen (UCLA 198) from Rito de Los Frijolis, Sandoval County, New Mexico, July 27, 1933, falls in this race and a specimen from Green River near the mouth of Sand

Wash about 2 or 3 miles above the mouth of Minnie Maud Creek, and about 15 miles downriver from Ouray, Unita County, Utah, collected by Wallace F. Wood June 2, 1933, although not examined, will presumably also fall in this race.

Range. The Colorado River Basin of Utah and Colorado; and also probably the mountainous region of northern New Mexico, possibly extending southward.

Habitat. The four snakes taken from the type locality were occupying a streamside habitat of trees and cultivated fields. The specimen taken on Green River was found in late afternoon crawling about in streamside cottonwood trees on the bank of the river. The one from northern New Mexico was found under a dead log in ponderosa pine and boxelder forest.

Comment. Mosauer (Occ. Papers Mus. Zool., Univ. Mich., 1942, 246:15) reports taking a specimen in extreme western Texas at Frijole, at the south end of the Guadalupe Mountains where they extend south from New Mexico. The characters given indicate that it falls within the limits of *intermontanus*, whose range may extend even farther south.

The noticeable reduction in scalation from the Texas specimens to those of Nebraska, extreme western Texas, New Mexico, and the Colorado Basin in Utah and Colorado suggests the idea that the reduction is an isolation phenomenon. That it might be a latitudinal phenomenon, seems hardly tenable in view of the geographic relationships involved.



Woodbury, Angus M. and Woodbury, Dixon M. 1942. "Studies of the rat snake, *Elaphe laeta*, with description of a new subspecies." *Proceedings of the Biological Society of Washington* 55, 133–142.

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