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A TAXONOMIC STUDY OF THE RATSNAKES,
GENUS *ELAPHE* FITZINGER

V. THE ROSALIE SECTION

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THIS paper presents a detailed geographic and variational study on the ratsnakes *Elaphe rosaliae* Mocquard and *E. subocularis* Brown. These two species are similar to each other in scutellation, body proportions, and particularly in hemipenial characteristics. They differ in the last character from all other American members of the genus, and are here recognized as belonging to a separate section. *E. rosaliae* is found in the southern half of Baja California; *E. subocularis* ranges through Coahuila, western Texas, and southern New Mexico (Map 1). Although no comprehensive work has been published on either of these species, their mutual relationship was recognized long ago by Schmidt (1925: 88). Both species are rare in museum collections, with only four known specimens of *E. rosaliae* and fewer than 50 of *E. subocularis*.

GENERAL DESCRIPTION

The two species differ considerably in pattern and slightly in body proportions and scutellation. They have a great many similarities, however, and some aspects of their structure may be discussed together.

DEFINITION OF THE ROSALIE SECTION.—Snakes of the genus *Elaphe* having a small hemipenis which extends to the ninth or tenth caudal in the inverted position, without basal hooks or distal lobes, and with the proximal part covered with very fine spinules (Plate I *a-b*). There is a lorilabial row of three to seven scales, and usually 10 or 11 supralabials (Fig. 1). The ventrals range from 260 (*E. subocularis*) to 287 (*E. rosaliae*); the caudals from 69 (*E. subocularis*) to 89 (*E.*

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rosaliae). There is no appreciable sexual dimorphism in any character of scutellation or pattern.

BODY PROPORTIONS AND SIZE.—Both of these species are large snakes with slender necks, distinct heads, and short tails as compared with other snakes in the genus. Of the four known specimens of *Elaphe rosaliae*, one has a body length of almost a meter, whereas in the much larger series of *E. subocularis* the largest specimen approaches 1500 mm. in body length. The proportions are similar in the two species; the body stout at mid-section and tapering markedly toward either end. The head appears large in comparison with the slender neck but makes up only about 3.5 per cent of the body length. It is flat dorsally with a broad, abruptly rounded snout and a distinct angular canthal region. The temporal area is massive (especially in the larger individuals of *E. subocularis*) and broadly rounded. The supralabial region projects well beyond the level of the eye. The size of the eye differs sharply in the two species, being considerably larger in *E. subocularis*. The tail is short in both, equaling about 19 per cent of the body length in *E. rosaliae* and about 15 per cent in adult *E. subocularis*. (This compares with a tail length of 20 to 35 per cent in adult *E. obsoleta*.) The tail is proportionately longer in juveniles (of *E. subocularis*), averaging between 16 and 17 per cent of body length in individuals with body lengths of 500 to 1000 mm. and nearly 18 per cent in smaller specimens.

SKELETON AND TEETH.—It was noted in one specimen of *E. subocularis* which had a slit at mid-body that the hypapophyses had disappeared somewhere anterior to ventral 150 (no skeletons are available). The single available skull (of the same species) shows no outstanding differences from the skulls of most other species of *Elaphe*. The nasal bone is rounded laterally, as in other species (except *E. triaspis*). This skull (UMMZ S-1081) has the following tooth counts: maxillary 20-20, palatine 11-11, pterygoid 15-16, dentary 24-25. The teeth on all bones decrease slightly in length posteriorly.

The maxillary teeth of *E. rosaliae* had counts of 19 and 20 in the two specimens. They ranged from 19 to 21 with a mean of about 20 in *E. subocularis*, except for a single individual (TNHC 8453) which had a gap (perhaps an old wound) just anterior to the third tooth from the posterior end, giving a count of 18.

HEMIPENIS.—The hemipenis is almost identical in the two species, that of *E. rosaliae* possibly having somewhat smaller spinules on the proximal part. The organ is small in comparison with that of other species of *Elaphe* and closely resembles that of *Pituophis* (Stull, 1940:

10) in both form and ornamentation (Plate 1a-b). In the inverted position it extends posteriorly to the ninth or tenth caudal and extends to about the eighth when everted. The proximal third of the organ has spinules scattered over an otherwise smooth surface. The middle half is covered with 12 to 17 irregular rows of spines, most of which are connected in one direction by a series of low membranes which run obliquely and give a spiral appearance to the spiny part. Membranes which run perpendicularly to the first spines appear distally (by the fourth to seventh transverse row of spines) and join with the others to form irregularly hexagonal calyces with a spine at each corner and some intermediate ones. The spines decrease in size abruptly from this point, and by the second or third distal row of calyces they have disappeared completely, leaving two to six rows of low and irregular papillate calyces distally. The lips of the single sulcus are not conspicuously raised; they are ornamented with small spines in the middle area and calyces in the more distal part.

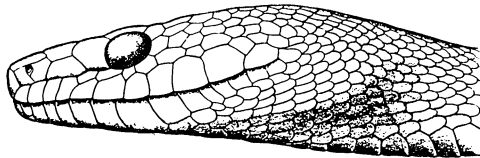


FIG. 1. Lateral view of the head of *Elaphe rosaliae* showing the large number of supralabials and the lorilabial row of scales.

SCUTELLATION.—The presence of a lorilabial row of scales (Fig. 1) in the two species of this section is highly characteristic and occurs in no other American species of *Elaphe*. The large number of ventrals (more than 260) combined with the relatively small number of caudals (fewer than 90) is also characteristic of this section, and the large remainder obtained by subtracting the number of caudals from the number of ventrals (190 plus) is obtained in no other form. The large number of supralabials, usually 10 or 11 in contrast to the ordinary eight or nine of other species, is also unusual for American colubrids (a number as great as 10 occurs in a few individuals of *E. flavirufa* and *E. triaspis*). Other scales (i.e., temporals and dorsals) also occur in large numbers, but are not as distinctive as those mentioned above.

SEXUAL DIMORPHISM

These snakes are unique among American species of *Elaphe* in that not a single observed morphological character has sufficient sexual dimorphism to be demonstrated in the available series. A slightly greater number of caudals in males is suggested by the maximum numbers observed in the two sexes, but the means of the caudals are not significantly different.

RELATIONSHIPS

As indicated above, these snakes differ from all other American species of *Elaphe* in scutellation, body proportions, and type of hemipenis. There is no evidence of recent or close relationship with any of the other American species. The similarity of the hemipenes of the snakes of this section of *Elaphe* to those of snakes of the genus *Pituophis* is considerable and may be an indication that the latter genus was developed from these species. Further study is needed to assay the extent of relationship between the two genera, but the distinctive triangular nasal bones which prop the premaxillary in *Pituophis* remain as a differentiating feature. It is hoped that the relationship of this section with an Old World group will be investigated at a later date.

The interrelationship of the two forms in this section is as yet unsettled. Although closely related, they differ in a number of (apparently) unrelated characteristics. Since no intergrading specimens are available at this time, they are here treated as related allopatric species. For further discussion see the section on geographic variation in *E. subocularis*.

KEY TO SPECIES

The following key will identify correctly all known specimens of this section of *Elaphe*. It appears possible, however, that intermediate forms may yet be found in the almost unknown area between the known ranges of these forms (Map 1). Also, since the young of *E. rosaliae* are not known, it may be (as occurs in other species of *Elaphe*) that they are unlike the adults and possess a pattern. This would preclude the use of pattern as a key character but such individuals might be identified by their large numbers of ventrals and caudals.

- 1 No dorsal pattern; five or fewer dorsal scale rows keeled at mid-body *E. rosaliae* (p. 5)
 1' Dorsal pattern of dark and distinct H-shaped blotches; seven or more dorsal scale rows keeled at mid-body *E. subocularis* (p. 10)

The characteristics of the two species of this section are described below, with a discussion of the geographic and individual variation and a summary of their little-known natural history.

Elaphe rosaliae Mocquard

Coluber rosaliae Mocquard, 1899: 321-23, Pl. 12, Figs. 1-1b (original description; Santa Rosalia, Baja California).

Elaphe rosaliae (Mocquard), Stejneger and Barbour, 1917: 84 (listed). Nelson, 1921: 114 (listed). Van Denburgh and Slevin, 1921: 66-67 ("second known specimen," scutellation; San Bartolo, Baja California). Van Denburgh, 1922: 698-700 (description). Schmidt, 1925: 88 ("... evident relationship with [*E. subocularis*]").

Coluber rosaliae Mocquard, Werner, 1929: 80, 85 (in key, listed).

Elaphe rosaliae (Mocquard), Linsdale, 1932: 376 ("third and fourth known [specimens]," scutellation; San Ignacio and Comondu, Baja California). Ditmars, 1940: 234 (listed). Smith and Taylor, 1945: 60 (in key, listed). 1950: 323 (listed). Dowling, 1952: 8 (listed).

DEFINITION.—A unicolor reddish brown ratsnake (at least as adult) with a lorilabial row of five or six scales; 33 to 35 dorsal scale rows, of which five or fewer are keeled; 276 to 287 ventrals.

LOCATION OF TYPE SPECIMEN AND TYPE LOCALITY.—The type is in the Museum d'Histoire Naturelle, Paris (MNHP 92-438). It was collected at Santa Rosalia, Distrito Sur, Baja California, by M. Leon Diguët.

DESCRIPTION OF TYPE SPECIMEN.—The type is an adult female. It has not been available for study but is described (original description with some details supplied by M. Jean Guibé) as having the following characters: oculars 1 + 2; supralabials 10; infralabials 13; dorsals 33, smooth; ventrals 277; caudals 83; anal divided; maxillary teeth 17 or 18; body length 718 mm.; tail length 135 mm.

RANGE.—The southern half of the peninsula of Baja California.

DESCRIPTION OF SPECIES.—Of the four known specimens, two have been available for study. Both of the others have been described in the literature, and in addition the curators at the respective institutions have kindly supplied further information. These data are presented below along with the descriptions of the specimens at hand. Certain characteristics of *E. rosaliae* are also compared with those of *E. subocularis* in Table I.

The head in *E. rosaliae* is of moderate size as compared with other species of *Elaphe* and makes up about 3.5 per cent of the body

TABLE I
Certain Characters of Members of the Rosaliae Section

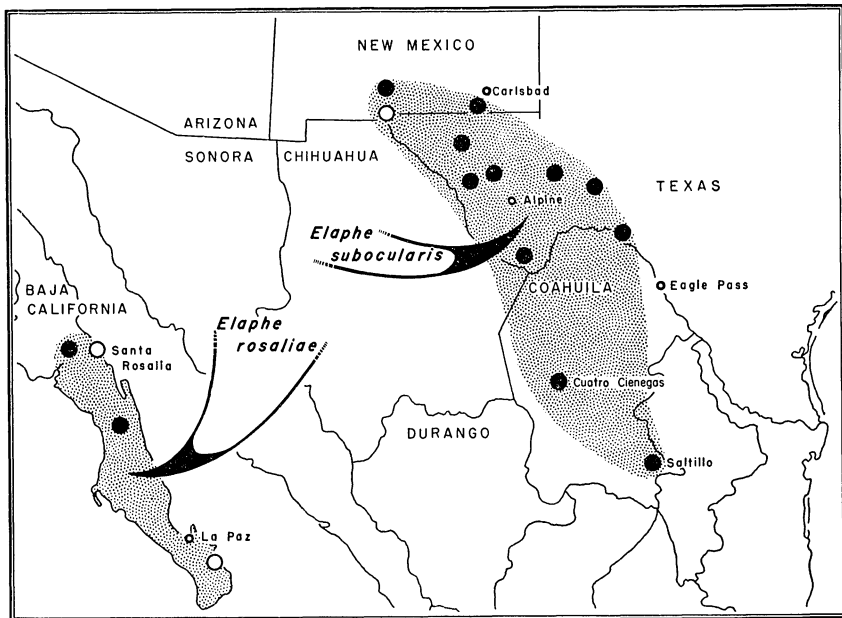
MALES	Pre-oculars	Post-oculars	Lori-labials	Supra-labials	Infra-labials	Dorsals	Ventrals	Caudals	Body Blotches	Tail Bloches	Mx
<u>E. subocularis</u>											
Davis Mts.	2 [5]	4 [5] 9? 10 11 [2] 12	20 [3] 22 [2] 28 [2]	26 27 28 [2]	29+31+20 29+33+21 [2] 31+35+21 31+35+23	267.4 (263-74)	74.0 (72-76)	26.2 (25-28)	8 [3]	19 20 [2] 21	
Sierra Vieja	2 [9]	4 [9] 6 7 8 9 [3] 10 [3]	20 [2] 21 [5] 22 [2]	28 [8] 30	29+31+21 29+33+23 31+33+23 [3] 31+35+23 [4]	268.4 (264-75)	74.0 (70-78)	24.9 (23-26)	7 8 [5] 9 [3]	19 20 [5] 21 [3]	
Stockton Plat.	2 [4]	4 [2] 5 [2] 7 8 11 13	20 [2] 22 [2] 23 30	28 [2] 29 30	29+33+22 29+33+23 29+35+23 31+35+23	274.3 (270-77)	74.7 (74-75)	25.8 (24-27)	8 [2] 9	20 [3]	
Chisos Mts.	2 [4]	4 [3] 5 10 11 [2] 12 14	20 21 22 [2] 23 32	28 29 30 [2] 32	29+31+21 29+31+23 29+33+20 29+33+21 31+35+23	273.0 (271-75)	77.7 (77-79)	25.8 (24-27)	9 [2] 10	20 [3] 21	
Saltillo	2	4 9	21 26	29+33+21	279	?	24	?	?	21	
<u>E. rosaliae</u>											
Comondu	2	4 11	20 25	29+33+21	276	83	0	20	0	20	
San Ignacio	2	4 11	22 29	30+35+23	287	89	0	19	0	19	

FEMALES											
<u>E. subocularis</u>											
New Mexico	2 [2]	4 [2]	7 10	22	28 30	31+33+23 [2]	265.5 (263-68)	69	25.5 (25-26)	?	20 21
Davis Mts.	2 [3] 3	4 [4]	9 10 11 12	20 21 [2] 22 [2]	27 28 [2] 30	29+31+21 29+33+23 [2] 30+33+23 [2]	264.0 (260-68)	74.2 (69-77)	24.2 (22-25)	7 [3] 8 [2]	20 [3]
Sierra Vieja	2 [3]	4 [1] 6 [2]	7 12 [2]	20 21 [2]	28 30 31	31+33+23 [2] 31+33+25	266.0 (261-69)	72.3 (72-73)	24.0 (23-25)	8 [3]	19 [2] 20
Stockton Plat.	?	?	?	24	?	29+33+23 31+35+23	270.5 (268-73)	73.5 (72-75)	24 [2]	8 9	20 [2]
Chisos Mts.	2	6	10	20	29	29+33+23 31+35+24	268.0 (263-73)	72	26 (25-27)	8	20
Cuatro Cienegas	2	4	6	22	29	33+35+25	266	76+	23	?	19
<u>E. rosaliae</u>											
Santa Rosalia	2	4	10?	20	26	33	277	83	0	0	18?
San Bartolo	2?	4?	10?	21	25	29+34+23	284	84	0	0	

Head scales are represented as both sides combined. Numbers in brackets give number of individuals in that class, numbers in parentheses give observed range. If no class number is given, only a single individual is represented. (Mx = number of maxillary teeth.)

and in broad contact with the frontal; there are two postoculars, the lower slightly larger and the upper inserted between the supraocular and parietal for about one-half its height; the temporals are in about five irregular rows of approximately $3 + 4 + 4 + 5 + 6$; the lorilabial row is made up of five or six scales; the supralabials are 10 or 11 and the infralabials are 12 to 15, averaging about 13. The anterior chin shields are larger than the posterior ones, the latter separated by a pair of small scales anteriorly and two or three scales posteriorly. There are five to seven gulars between the posterior chin shields and the first ventral scute.

The hemipenis (Pl. I) is quite similar to that of *E. subocularis*.



MAP 1. Known geographic distribution of the two members of the Rosaliae Section. Solid spots indicate specimens examined; open circles, literature records. Shaded areas show the general regions from which specimens have been taken and are not intended as predictions as to the actual limits of the ranges of these species.

NATURAL HISTORY

RANGE AND HABITAT.—The known geographic range is restricted to the southern half of Baja California (Map 1). The town of Santa Rosalia (the type locality) is the only coastal locality, and it seems possible that the type specimen actually originated farther inland

and was taken there. The information from Kenneth S. Norris (*in litt.*), who has spent considerable time in Baja California and visited this locality, tends to substantiate this idea. He wrote as follows: ". . . the territory at and near Santa Rosalia is one of the most arid sections of the peninsula. There are few trees, these mostly mesquite and palo blanco (*Lysiloma candida*). Much of the vegetation is creosote bush (*Larrea divaricata*) covered desert hills. Both [Charles H.] Lowe and I find it hard to believe that an *Elaphe* could be found at this location."

The four localities from which this snake has been recorded are in the "Arid Tropical Zone" of Nelson (1921, Pl. 32) and, with the exception of the type locality, are in areas having permanent fresh water. The localities for the three more recent specimens are deep valleys or barrancas with the permanently flowing water of large springs. Two of the localities, San Ignacio and Comondu, have a heavy growth of introduced date palms which take the place of much of the native vegetation. The San Bartolo locality in the Cape region is also watered by a large spring and is described as being heavily vegetated. Mr. Slevin wrote me, however, that the specimen he obtained there (CaAS 45982) was "found in mid morning on a stony hillside close to a dry sandy wash."

HABITS AND LIFE HISTORY.—The only note on the habits of these snakes is given above. The scarcity of specimens in collections correlated with the capture of two of them by ornithologists may be an indication of arboreal habits. The smaller size of the eye (*ca.* 13.5 per cent of head length), as well as Slevin's observation, "mid morning," indicates that *E. rosaliae* is a diurnal snake, in contrast to the closely related *E. subocularis*, which has nocturnal habits.

Elaphe subocularis Brown

Coluber subocularis Brown, 1901:492-95, Pl. 29 (original description; Davis Mountains, Jeff Davis County, Texas); 1903: 549 ("Eight specimens . . . have been collected. . . . All seem to have come from the Davis Mountains). Ditmars, 1907: 299 (food in captivity).

Elaphe subocularis (Brown), Stejneger and Barbour, 1917: 84 (listed). Blanchard, 1925: 13 (in key, Fig. 24). Schmidt, 1925: 87-88 ("evident relationship of this species with *Elaphe rosaliae*," range extension: McKilligon's Canyon, Mt. Franklin, El Paso County, Texas).

Coluber subocularis Brown, Werner, 1929: 80, 85 (in key, listed).

Elaphe subocularis (Brown), Smith, 1939: 317 (range extension; 28 miles east of Saltillo, Coahuila). Ditmars, 1940: 221 (color pattern). Schmidt and Davis, 1941: 153, Fig. 41 (description and range).

Elaphe sclerotica Smith, 1941: 135-36 (substitute name for *Coluber subocularis* Brown,

1901, a secondary homonym of *Bascanion suboculare* Cope, 1866).

Elaphe subocularis (Brown), Schmidt and Owens, 1944: 111 (new locality; Cuatro Ciénegas, Coahuila). Schmidt and Smith, 1944: 91-92 (new localities: Chisos Mountains, Brewster County, Texas). Smith and Taylor, 1945: 60 (range).

Elaphe sclerotica Smith, Lewis, 1948: 223 (range extensions; "near the eastern slope of the Organ Mountains, a few miles from San Augustine Pass," Dona Ana County, New Mexico).

Elaphe subocularis (Brown), Jameson and Flury, 1949: 67 (ecology; Miller Ranch, Presidio County, Texas). Flury, 1949: 293 (new locality; 12 miles west of Comstock, Val Verde County, Texas). B. C. Brown, 1950: 151-52 (range in Texas). Lewis, 1950: 9 (ecology, Organ Mountains, New Mexico). Smith and Taylor, 1950: 362 (listed). Dowling, 1952: 8-9 (listed). Pope, 1955; Fig. 108 (photograph). Jameson, 1956: 54-55 (feeding in captivity).

DEFINITION.—A yellowish ratsnake with 24 to 26 distinct brown or black H-shaped blotches on the body; a lorilabial row of three to six scales; 33 to 35 dorsals, of which at least seven are weakly (but distinctly) keeled at mid-body; 260 to 280 ventrals.

LOCATION OF TYPE SPECIMENS AND TYPE LOCALITY.—The holotype is ANSP 13733, collected "fifty miles southwest of Pecos, near the head of Toyah Creek," in the Davis Mountains, Jeff Davis County, Texas, by Mr. E. Meyenburgh. There are three paratopotypes, ANSP 13734-36.

DESCRIPTION OF TYPE SPECIMENS.—The holotype is an adult male with the following characters: oculars 1 + 2; temporals 3 + 4 + 6; lorilabials 6-5; supralabials 9-11; infralabials 14-14; gulars 7; ventrals 264; caudals 71 +. There are 25 body blotches and 8 (plus ?) on the tail. The body length is 1367 mm.; tail length 192 +; head length 44.0; eye 6.0.

The paratypes prove to have ventral counts of 274 (male), 261 (female), and 264 (female), rather than "about 240 . . . , 245 . . . , [and] 240," which were estimated from the live specimens by Brown (1901: 494-95).

RANGE.—From southern New Mexico southward and eastward through western Texas and Coahuila to the vicinity of Saltillo.

DESCRIPTION OF SPECIES.—Including the type series, there are now known a total of 44 specimens of *Elaphe subocularis*, representing 13 different localities. All of the specimens except two have been made available to me for this study and the following description is based on them.

This is one of the larger snakes of the genus; the largest specimen seen, as previously mentioned, has a body length of 1471 mm. and an incomplete tail of 199 mm. The head appears large in comparison with the slender neck in this species, but makes up only about 3.5

per cent of body length. The eye is large (ca. 16 per cent of head length), as would be expected in an animal of nocturnal habits.

The dorsal coloration of the body in life is a bright yellowish buff with an orange tinge anteriorly (these colors fade to light gray in alcohol). The head is light ash-gray, or has a yellowish tinge, and has no markings whatsoever in most specimens. One of the paratypes (ANSP 13736), however, has a small dark spot at each of the four anterior corners of the pentagonal frontal, as does one other specimen from this locality (ANSP 17050). The eye is described as gold-colored. The dorsal body pattern is very distinctive and differs from that of all other North American snakes in appearance. It is approached most closely by *Pituophis deppei* in its general aspect, but differs in detail (Pl. II). The pattern is made up basically of a dorsal series of large, well-defined, black or dark brown H-shaped blotches that are about 15 scale rows in width and eight to ten scales in length. The middle part of the lateral bar of the blotch has an open appearance because the dark color is restricted to the center of each scale; the crossbar has a similar appearance, but this is due to the restriction of the dark color to the edges of the scales. Anteriorly, the lateral longitudinal extensions of the first few blotches are connected by a black line which is about one scale in width. Often the anterior one or two blotches have lost the crossbar almost completely, their positions merely being indicated by widening of the parallel longitudinal lines at regular intervals. (These are included in the blotch counts.) The posterior blotches are also connected, but by a faint maroon line that often disappears in preserved specimens. The blotches become smaller posteriorly as the body diminishes in size, but remain distinct even on the tail, which usually has eight or nine blotches.

The lateral markings begin on the neck as a series of short and very narrow dark lines that both alternate with and oppose the dorsal blotches. Farther posteriorly these lines broaden to blotches with a height of about five scales but remain irregular and faint, the darker coloration being restricted to the edges of the scales. In the area of greatest development (at mid-body) the lateral blotches extend from the eighth or ninth scale row downward to the ventral border, often splitting there and extending outward to form a pair of ventrolateral blotches about two scales wide and separated by about the same distance. The ventral surface of the body is immaculate yellowish white anteriorly, but posteriorly the lateral blotches extend onto the lateral edges of the ventrals as described above.

The dorsal scales above the fifth row are weakly but distinctly

keeled in all of the adult specimens from Texas and New Mexico. In the juvenile individuals the keels are less distinct and may not be visible ventral to scale row VII or VIII. The scale reduction, although involving a large number of rows, does not show any significant difference from other species of American *Elaphe*. The scale formula of the holotype (ANSP 13733) is given below.

$$\begin{array}{cccccccc}
 33 & \frac{7+8(11)}{7+8(12)} & 31 & \frac{6+7(20)}{6+7(19)} & 29 & \frac{+7(59)}{+7(55)} & 31 & \frac{+9(80)}{+9(86)} & 33 & \frac{-8(141)}{7+8(136)} & 31 & \text{---} \\
 \text{---} & 31 & \frac{-8(149)}{7+8(151)} & 29 & \frac{5+6(159)}{7+8(160)} & 27 & \frac{6+7(167)}{7+8(167)} & 25 & \frac{4+5(201)}{-5(195)} & 23 & \frac{4+5(246)}{4+5(245)} & 21 \text{ (264)}
 \end{array}$$

The ventrals have no demonstrable sexual dimorphism (Table I). The caudal counts suggest some dimorphism, with the females having slightly fewer than the males, but this cannot be demonstrated with the small numbers of specimens available. The anal plate is divided in all specimens examined.

The head scutes are normal for the genus with the addition of the lorilabial row of scales, which appear to be split off the dorsal edges of the supralabials. The rostral is rounded and slightly wider than high. It possesses a rather shallow but well-defined tongue groove and is in narrow contact with the internasals. The frontal is almost twice as long as broad with a wide curving anterior end and a rather obtusely pointed posterior end. The supraoculars are longer than the frontal and are usually in narrow contact with the prefrontals, though sometimes separated from them by an upward extension of the preocular. The parietals are rather short, the interparietal suture being shorter than the frontal. The nostril is between two large unequal nasals; the anterior one is the longer, the posterior is the higher. The loreal is large with its anterior end squarish, the lower and posterior corner is acute and extends well under the large preocular. The latter is usually separated from the frontal, but may be in narrow contact with it. There are two postoculars, of which the lower is the larger; the upper extends for more than half its height between the supraocular and the parietal. The temporals are in about five irregular rows of approximately 3+3+4+5+6 (one side), but there is considerable variation. The lorilabial row usually extends from the posterior end of the loreal to the anterior corner of the ninth labial and is composed of three to six scales. This row often separates the eye from the labial border, but this is

not true in 18 individuals in which the ocular is in contact with the supralabials on one or both sides. The supralabials range in number from nine to 12 ($M = 10.5$), and the infralabials from 13 to 17 ($M = 14.5$). The anterior chin shields are somewhat longer and much broader than the posterior. The latter are separated anteriorly by a pair of small scales and posteriorly by three or four scales. There are five to seven gular scales between the posterior chin shield and the first ventral plate.

The hemipenis was described above (pp. 2-3), as was the skull (p. 2).

GEOGRAPHIC VARIATION

Small series of specimens are available from three localities, and a comparison of these with one another and with the other scattered individuals gives an indication of some geographic trends, although mostly the series are too small to make the results statistically significant. The statistics of the ventral and caudal counts are given graphically (Fig. 2) for the series; the labial counts and certain other data are given in Table I. Other information is given in the following paragraphs.

DAVIS MOUNTAIN SERIES.—Including the type specimens there are nine (five males and four females) individuals now available from this mountain range. The body blotches vary from 22 to 28, with a mean of 25.3 ± 0.55 ; the tail blotches are 7 (three individuals) or 8 (four). The dorsal scales range from $29 + 31 + 20$ to $31 + 35 + 23$, with $29 + 33 + 23$ occurring most frequently. The maxillary teeth are 19 (one individual), 20 (three), or 21 (two).

SIERRA VIEJA SERIES.—This group of snakes (nine males and three females) was obtained by members of the Department of Zoology, University of Texas, and is the largest representation of *E. subocularis* from any one locality. The entire series is from near the mouth of ZH Canyon, on the C. E. Miller ranch 11 miles west of Valentine, Jeff Davis County. The body blotches range from 23 to 26 with a mean of 24.7 ± 0.33 ; the tail blotches are 7 (one individual), 8 (eight), or 9 (three). The dorsals are usually $31 + 33 + 23$, being $29 + 31 + 21$ in one individual, $31 + 33 + 25$ in another, and $31 + 35 + 23$ in four. The maxillary teeth are 19 (three individuals), 20 (six), or 21 (three).

CHISOS MOUNTAIN SERIES.—The seven specimens (five males and two females) that make up this series are from several localities within the mountain range. Only four have complete tails. The body blotches range from 24 to 27, with a mean of 25.7; the tail blotches

are 8 (one individual), 9 (two), or 10 (one). The range in dorsals is included within those of the other two series. The maxillary teeth are 20 (four) or 21 (one) in the five adult specimens.

DISCUSSION.—The three series indicate a trend of increasing scale numbers toward the south. This trend is not demonstrated by statis-

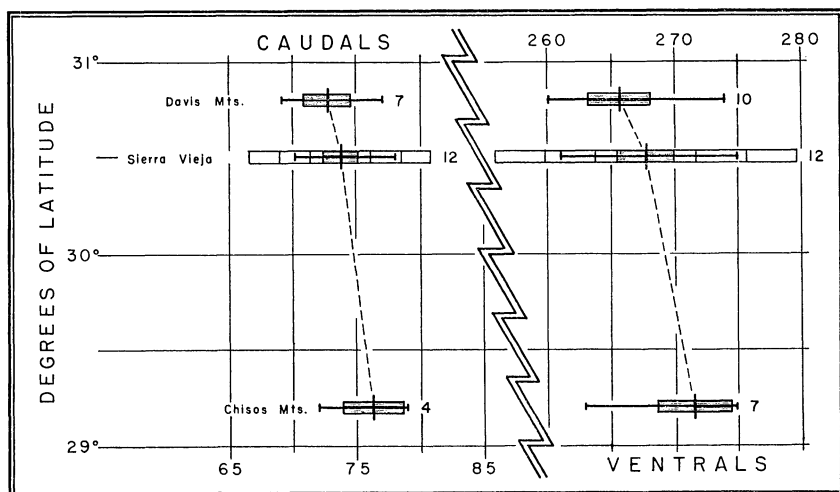


FIG. 2. *Elaphe subocularis*: variation in caudals and ventrals of the three available series plotted in relation to their geographic latitude. In each sample the observed range is shown by a broad horizontal line, the mean by a vertical line, and two standard errors on either side of the mean by shaded rectangles. The number of individuals is shown at the right of each figure. The means of the samples are connected with dashed lines, showing the apparent increase in scutes southward. Three standard deviations (99.7 per cent of the expected variation in this population) are shown as open rectangles for the Sierra Vieja series, which is the largest and has the most nearly normal distribution. (The standard errors of all series were calculated from the standard deviation of this sample. Although this may introduce a mathematical error, it is believed that the introduced error is less than the one which would be made by using the small and badly skewed distributions of the other series.)

tically significant results in the individual characters, but the evidence produced by similar increases in ventrals, caudals, and supra- and infralabials appears too great to be mere coincidence. It should be noted also that the two specimens from New Mexico, the northernmost ones, have 263 and 268 ventrals, whereas the ventrals in snakes from Terrell and Val Verde counties, Texas, south and east of the Davis Mountains vary from 270 to 277, with a mean in five snakes of 274. The southward continuance of this is evidenced in the single specimen from the vicinity of Saltillo, Coahuila, which has 279 ven-

trials, the maximum number observed. The apparent break in the trend is shown by the single specimen from Cuatro Cienegas, Coahuila, with 266 ventrals. However, the ventral count of the Cuatro Cienegas specimen is probably low for its population, as indicated by the (usually correlated) large number of caudals.

Other than the slight trends noted above, the specimens from West Texas and southern New Mexico are homogeneous and show little sign of differentiation. A single specimen without locality data (CNHM 38943), therefore, holds unusual interest in that it tends to break down the differences in characters which separate *E. subocularis* from *E. rosaliae*, and this tendency is shown in other ways by the two specimens from Coahuila.

The differences between the Coahuila specimens and others are not great and are observable only upon close comparison with *E. subocularis* from other areas. The one from near Saltillo (CM 9781) differs mainly in the increased number of ventrals (which range from 277 to 286 in *E. rosaliae*): 279 as compared with an observed upper limit, otherwise 277 (the largest series of *E. subocularis*, from Sierra Vieja, has an observed range of 264 to 275 and a mean of 268.4). The tail is broken off short. The specimen from Cuatro Cienegas (CNHM 47048), an adult female, differs in two main characters: fewer dorsals are keeled, there being 10 smooth lateral rows at mid-body as compared with two to five in other adults; and the tail is longer even though the tip is broken off, being 18.3 per cent of body length as compared with an observed range of 15.9 to 16.9 in other snakes of the same size and sex. The caudals also reflect the longer tail, there being 76 + in this individual as compared with an observed upper limit of 77 in other females. Both the scales and tail length thus show an approach toward the smoother-scaled, longer-tailed *E. rosaliae*.

The above-mentioned specimen without locality data shows an even greater approach toward *E. rosaliae*. It is an adult male with a total length of 1609 mm. The tail is slightly longer than in other snakes of this species (15.9 per cent of body length as compared with a maximum of 15.4 in snakes of comparable size), with more caudals (81 as compared with the observed upper limit of 79 in other males), and more than the average number of ventrals, equaling the observed upper limit of 277 for Texas specimens. The dorsals are smoother than average, there being eight smooth rows at mid-body. The most striking change, however, is in the body pattern. In other specimens the only observed variation was in the number of blotches. This individual differs from all others in that the dorsal pattern is distinct

only on the anterior part of the body. None of the more posterior blotches have the longitudinally parallel lines of the usually H-shaped pattern, and the crossbar itself is very faint at the posterior end of the body. Unfortunately, the eye cannot be measured due to the condition of the specimen. Were it known that this snake came from a geographically intermediate area, I would not hesitate to consider it a member of an intergrading population between *E. subocularis* and *E. rosaliae*.

It is to be hoped that further field work in the area between the known ranges of these two forms will bring other specimens to light. The structural gap between the nominal species has almost been bridged by these three specimens, and further material may afford evidence as to their true relationships. The keeling of the dorsal scales, or lack of it, appears to be a quantitative difference in the genus *Elaphe* rather than a qualitative one.

NATURAL HISTORY

HABITAT AND RANGE.—This species is one of the northern plateau forms which inhabits the slightly more humid mountain areas of this arid region. The known distribution extends from the Organ and Guadalupe mountains of southern New Mexico through the Franklin, Davis, and Sierra Vieja mountains of west Texas, and the Chisos Mountains and Stockton Plateau of the Big Bend region, southward through outliers of the Sierra Madre Oriental to the vicinity of Saltillo, Coahuila (Map 1).

A synthesis of the descriptions of the various habitats which have been ascribed to this snake gives little idea of what factors may influence its distribution. The Organ Mountains specimen (PSM 6063) was taken in an outbuilding standing in a yucca-mesquite-ephedra-grassland association at an altitude of about 4100 feet. The Sierra Vieja individuals were taken in a variety of associations, but mainly in catclaw-cedar and catclaw-grama. It should be pointed out, however, that all have been collected from mountains or otherwise rough country and were usually found in or near rocky situations, as indicated by the Stockton Plateau specimens (Milstead, Mecham, and McClintock, 1950: 555). Most of those from Texas seem to have been collected from situations not far from permanent water, but this does not appear to be true of the Organ Mountains individual, nor of some of the others.

HABITS AND LIFE HISTORY.—Almost nothing is known of the habits of *E. subocularis*. The series of specimens from Sierra Vieja was taken

"between sunset and about 10 P.M.," which corroborates the supposition that they are nocturnal, as evidenced by their large eyes. Since none of the snakes had "obvious food lumps" at that time, it may be further assumed that the greater part of the night is spent foraging unless the temperature drops too low. The fact that one of the specimens was located by the reflection of light from its eyes (Jameson and Flury, 1949: 67) is probably nothing more than another indication of their size, since size appears to be a determining factor for "eye shine" in amphibians and reptiles.

These snakes have been little known, and their food habits in the wild do not appear to have been described. Ditmars (1907: 300) recorded that the three young captive snakes under his observation ate mice and young birds readily. Jameson (1956: 55-56) reported a captive feeding on mice (*Peromyscus pectoralis*) with, incidentally, a habit like that of *Pituophis*. One of the specimens examined (UMMZ 91471) had had the feet of a roadrunner (*Geococcyx californianus*) removed from its stomach, and another (THHC 7680) had the remains of a small mammal. If these snakes can catch and eat as large a bird as a roadrunner, even at night, then they must be able to feed on most of the species of birds and smaller mammals that occur within their range.

SUMMARY AND CONCLUSIONS

A detailed study of the ratsnakes *Elaphe rosaliae* Mocquard and *E. subocularis* Brown was made and a description of the proportions, scutellation, color pattern, and characters of teeth, skeleton, and hemipenis was presented. The mutual relationship of these two species is indicated by similarities in all of the characteristics except pattern. Their separation from other American members of the genus *Elaphe* and their relationship with the genus *Pituophis* is indicated in particular by the type of hemipenis which is found, so far as known, only in these snakes.

The two forms described here, although obvious allopatric relatives, are considered to be separate species since no intergrading populations are known and since the differences between the two forms are more numerous and of greater extent than are the ordinary differences between subspecies in better-known snakes. Nevertheless, they have a great many similarities and their geographic distribution (as suggested by Schmidt, 1925: 88) indicates their common derivation from a species which ranged over the southwest during pluvial times.

Considering the kind and amount of divergence between the two, and the relatively homogeneous population of each, it is here suggested that these forms were still in contact (though perhaps somewhat differentiated) during the last pluvial stage (Wisconsin) of the Pleistocene epoch, and that they were separated by the extremely arid conditions which followed immediately thereafter. This appears to be the minimal as well as the most logical estimate, and allows some 5,000 to 6,000 years for their further divergence as (probably) small relic populations.

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SPECIMENS EXAMINED

Elaphe rosaliae

MEXICO: Baja California, Comondu (MVZ 13767), San Ignacio (MVZ 10672).

Elaphe subocularis

NEW MEXICO: *Dona Ana Co.*, Organ Mts. near San Augustine Pass (PSM 6063); *Eddy Co.*, near Carlsbad Caverns (KUMNH 8436).

TEXAS: *Brewster Co.*, Black Gap (TNHC 12888), Chisos Mts. (CAS 7823, 12242-43; CNHM 27702; UMMZ 90634; USNM 103664); *Culberson Co.*, 20 mi. N. of Van Horn (UMMZ 91470), 23 mi. N. of Van Horn (UMMZ 91471); *Jeff Davis Co.*, Davis Mts. (ANSP 13733, holotype, 13734-36, paratypes, 17049-50, 22179; AMNH 28372; MCZ 6652), Phantom Lake (UMMZ 50002); *Pecos Co.*, Fort Stockton (TCWM 207); *Presidio Co.*, C. E. Miller Ranch, 11 mi. W. of Valentine (TNHC 3284, 3286, 3290, 3348, 3492, 3522, 3883-85, 3904, 3920-21); *Terrell Co.*, 6 mi. SE. of Dryden (TNHC 12506), N. D., Blackstone Ranch, 12 mi. S. of Sheffield (TNHC 7680, 8130, 8453); *Val Verde Co.*, 12.5 mi. W. of Comstock (TNHC 4771).

MEXICO: Coahuila, Cuatro Ciénegas (CNHM 47048); 28 mi. E. of Saltillo (CM 9781).

NO DATE: CNHM 38043.

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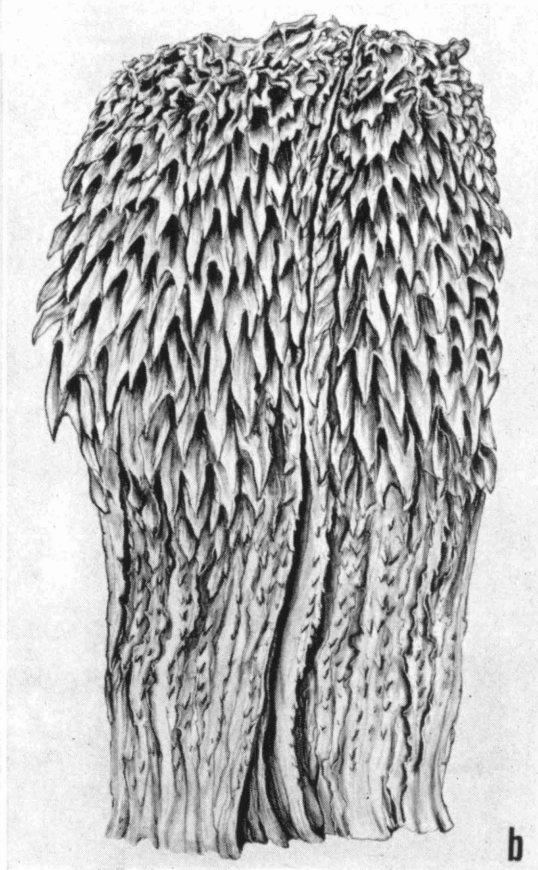
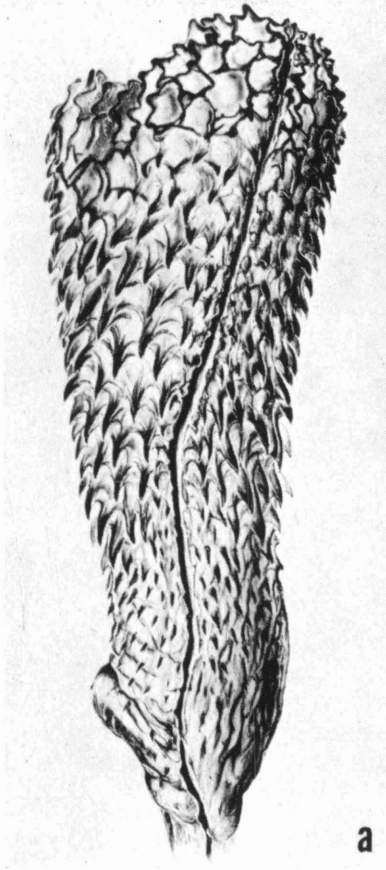
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PLATES

PLATE I

Hemipenes of members of the Rosaliae Section of the genus *Elaphe*: a. *E. subocularis*, everted; b. *E. rosaliae*, dissected out and split longitudinally. Although the preparation of the two specimens is different, their similarities are obvious. The presence of the spinules on the proximal third of the organ (found in no other American member of the genus) is distinctive for this section. In addition, the absence of especially elongated proximal spines (basal hooks) distinguishes it further from that of *E. triaspis*, and the absence of large distal lobes distinguishes it from that of other American species. Drawings from preserved specimens by William L. Brudon.

PLATE I



Herndon G. Dowling

PLATE II

Elaphe subocularis. The difference between this pattern and the blotched, striped, or unicolor appearance of the better known species is striking. The nearest approach to this pattern appears to be found in the Mexican bullsnake, *Pituophis deppei* (Stull, 1940: 45-46, 50). Photograph of an individual from Brewster County, Texas, by Isabelle Hunt Conant.

PLATE II

