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THE HERPETOFAUNA OF QUERETARO, MEXICO, WITH REMARKS ON TAXONOMIC PROBLEMS

JAMES R. DIXON, CHESLEY A. KETCHERSID, AND CARL S. LIEB

Department of Wildlife and Fisheries Sciences, Texas A&M University, College Station

ABSTRACT. For the past three years, a herpetofaunal study of an ecological transect through the eastern front range of the Sierra Madre Oriental has been conducted in the Mexican states of San Luis Potosí and Querétaro. The transect passes through tropical deciduous, semi-cloud, pine-oak, dry oak and desert scrub forests within the first 65 kilometers, transversing elevations from 90 to 2,550 m. Brief descriptions of the various major vegetational areas are included. Sixty-five new herpetofaunal records are listed for the state of Queretaro. A discussion of systematic problems includes the species *Pseudoeurycea cephalica, Sceloporus jarrovi, Eumeces lynxe, E. tetragrammus, Lepidophyma flavimaculatum, L. gaigeae,* and *L. smithi.*

A vast amount of information on the distribution and systematics of Mexican reptiles and amphibians has accumulated over the past 20 years, or since the last publication of the Smith and Taylor (1945, 1948, 1950) checklists on the herpetofauna of Mexico. During this surge of interest, large amounts of data were accumulated on various aspects of the biology of families, genera and species, including specific studies on their distribution within political boundaries of Mexico. Smith and Taylor (1945, 1948, 1950) included state lists in each of their publications, and some major contributors to specific state and regional studies were Alvarez del Toro (1960); Bogert and Oliver (1945); Davis and Dixon (1959, 1961, 1965); Davis and Smith (1953a, 1953b, 1953c); Duellman (1958, 1960a, 1961, 1965a, 1965b); Hardy and McDiarmid (1969); Martin (1958); Schmidt (1922); and Taylor (1949, 1952, 1953). In general, there are several hundred assorted notes and short papers on range extensions, systematics, ecology and morphology of Mexican amphibians and reptiles.

Specific locality records of amphibians and reptiles for Queretaro are given by Altig (1964); Chrapliwy (1964); Dixon and Ketchersid (1969); Duellman (1960b, 1970); Klauber (1952); Lynch (1970); Martin del Campo (1936); Rabb (1965); Smith (1942); Smith and Brandon (1968); Smith and Taylor (1945, 1948, 1950); Webb (1968); and Zweifel (1956).

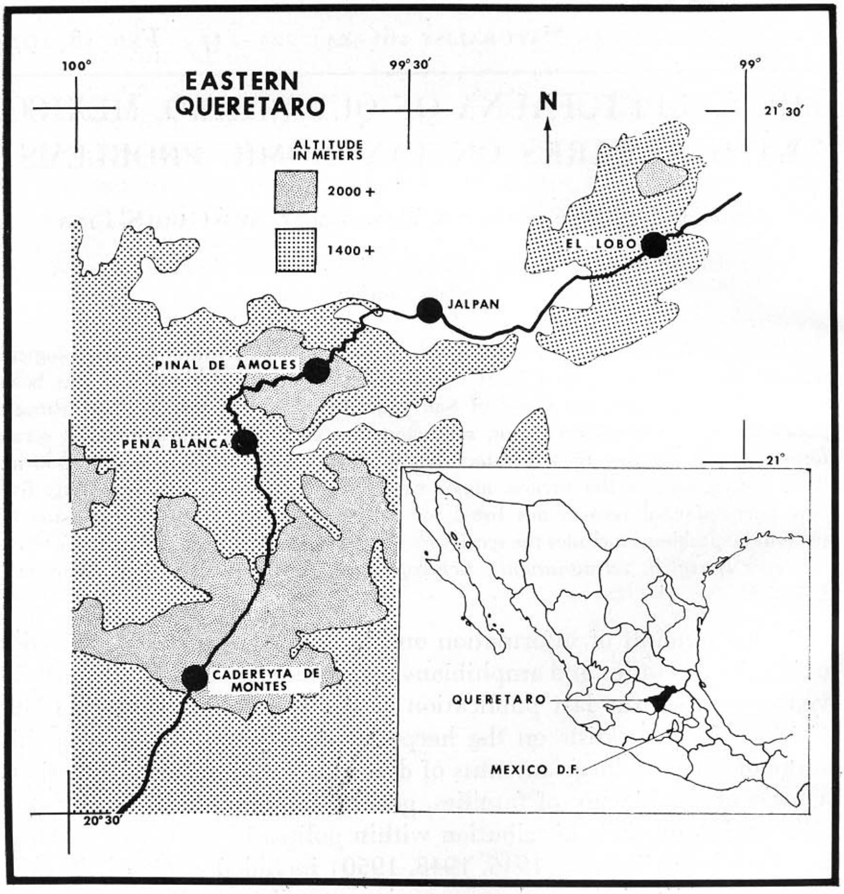

Fig. 1. General collecting areas in eastern Queretaro, Mexico, along Mexico highway 120.

One of us (Ketchersid) has been conducting a herpetofaunal study of an ecological transect through the eastern front range of the Sierra Madre Oriental in the Mexican states of San Luis Potosí and Querétaro, for the past three summers (1968–70). The transect is bounded by the Río Santa Maria on the north, and the Río Moctezuma on the south. One major road traverses the area from Mexico highway 85, San Luis Potosí, to Mexico highway 57, Querétaro, and lies in an east-northeast to west-southwest direction. The road traverses several types of vegetation, such as tropical deciduous, semi-cloud, pine-oak, dry oak and desert scrub forests within the first 65 km. Elevations along the route vary from 90 to 2,550 m.

The essence of this paper is to report new herpetofaunal records for the state of Querétaro, discuss some of the more difficult systematic problems encountered during the course of the study and describe briefly the major vegetation zones included in the ecological transect.

Table 1 provides a list of 27 species previously recorded from the state and 65 species new for the state. Information contained in this paper is based on approximately 2100 specimens collected by Texas A&M University field parties over a three year period, and a few scattered specimens from other museums.

DESCRIPTION OF STUDY AREA. The ecological transect traverses five major vegetation areas. These have been designated as the El Lobo, Jalpan, Pinál de Amoles, Pena Blanca and Cadereyta areas; so named for the village lying nearest to the center of the area.

The dominant trees of the El Lobo area consist primarily of oaks with some pine, madroño (*Arbutus glandulosa*), cedar, sweetgum and scattered walnut. Many low shrubs and ferns are present on the forest floor. At higher elevations on the northeastern and eastern slopes, the forest is essentially deciduous with numerous epiphytes. The terrain is mountainous, the soils are principally limestone, and sinks and caves are common throughout the area. In cleared areas a low grass and holly-type shrub predominates. The pine-oak forest of this area is found above 1515 m. on the eastern slopes of the transect. Below 1500 m., it is replaced by a forest consisting of sweetgum and walnut. On the western slope, the pine-oak descends to 1650 m. where it gives way to oak, acacia and some palmetto-like vegetation.

The Jalpan area may be described as a thorn-scrub region, abundant in acacia with scattered cacti and non-thorny shrubs. The Río Jalpan flows through the area and is lined with large cypress (*Taxodium mucvonatum*) trees. A tree resembling wild plum is found throughout the valley, usually near fence rows and never in abundance. A tall festucoid grass is occasionally found on northern slopes of the valley, and a medium sized panicoid or eragrostoid grass occurs in patches throughout the area and along the edge of roads. Most of the pasture vegetation of the region is short-grasses. Along the northeast slopes where land has not been cleared for farming, other thorny trees and brush form an impenetrable forest. Locally, where small springs appear at various locations throughout the valley, large ornamental trees and such fruit bearing plants as bananas, apples, mangos and oranges are abundant.

The Pinál de Amoles area is a pine-oak region, with the drooping needle pine (*Pinus teocote*) the abundant evergreen. The forest floor

TABLE 1

A list of 92 amphibians and reptiles from the Mexican state of Queretaro, based on literature records (*) and new additions from recent collections. Collections housing the new records are American Museum of Natural History (1); Bryce C. Brown, Waco, Texas (2); University of Kansas (3); Michigan State University (4); Texas Cooperative Wildlife Collection (5); University of Illinois Museum of Natural History (6); University of Michigan Museum of Zoology (7); United States National Museum (8). The number following the scientific name represents the museum housing the specimen(s). Columns to the right represent general area of occurrence. The letter L in the right hand column indicates a literature record only; the specimen in question has not been located in any museum.

Species	El Lobo	Jalpan	Pinal de Amoles	Pena Blanca	Cadereyta
Chiropterotriton chondrostega[5]	X				
Chiropterotriton multidentata[7]			X		
**Chiropterotriton magnipes*[2,5,7]	X				
**Pseudoeurycea belli*[2,5]	X		X		
Pseudoeurycea cephalica[2,5,7]	X		X		
**Bufo compactilis*[3,7]					X
Bufo marinus[5]		X		X	
Bufo occidentalis[3,5]		X		X	X
Bufo punctatus[5,7]				X	X
Bufo valliceps[2,5,8]		X			
**Eleutherodactylus augusti*[3,5,7]	X	X	X		
Eleutherodactylus decoratus[2,3,5]	X				
**Hyla arenicolor*[2,3,5,7]					X
**Hyla eximia*[3,5]	X	X			X
Hyla miotympanum[5]		X			
Hypopachus variolosus[5]		X			
**Rana montezumae*[2,7]					X
**Rana pipiens*[2,3,5,7]	X	X	X	X	X
Scaphiopus couchi[5]		X			
Scaphiopus hammondi[3,5,7]					X
Smilisca baudini[5]		X			
**Syrrhophus longipes*[3,5]	X				
**Syrrhophus verrucipes*[2,5,7]	X	X	X		
Kinosternon cruentatum[5]		X			
Kinosternon hirtipes[1]					X
Kinosternon integrum[7]					X
Anolis sericeus[5]		X			
Abronia taeniata[5]	X				
Barisia imbricata[5]			X		
Cnemidophorus gularis[5,7,8]		X		X	
**Cnemidophorus sacki* (=*scalaris*)[5,7]					X
**Eumeces callicephalus*					L
**Eumeces lynxe*[4,5,7]	X		X		
Eumeces tetragrammus[5]	X	X			
Gerrhonotus liocephalus[5]	X				
Lepidophyma flavimaculatum[5,7]	X				
Lepidophyma gaigeae[2,5,7]	X	X			
**Lepidophyma smithi*[5,8]		X			
**Phrynosoma obliculare*[7]					X
Sceloporus (new species)[5]				X	
Sceloporus aeneus[5]			X		
Sceloporus grammicus[2,5,7]	X		X		X
**Sceloporus jarrovi*[5,7,8]	X	X	X		X
Sceloporus parvus[5]				X	X
Sceloporus scalaris[5]	X				

TABLE 1—Continued

Species	El Lobo	Jalpan	Pinal de Amoles	Pena Blanca	Cadereyta
Sceloporus spinosus[3,5,7]		X		X	X
Sceloporus torquatus[5,7]	X		X		X
*Sceloporus variabilis[5,7,8]	X	X		X	
Scincella caudequinae[5]	X	X			
Adelphicos quadrivirgatus[5]	X				
Boa constrictor[5]		X			
*Chersodromus rubriventris[5]	X				
Conopsis nasus[5,7]					X
Crotalus atrox[5]				X	
Crotalus durissus[5]	X				
*Crotalus molossus[7]					X
Crotalus scutulatus[7]					X
*Crotalus triseriatus[5,7]	X				X
Drymarchon corais[5]	X	X			
Drymobius margaretiferus[5]		X			
*Elaphe flavirufa		L			
Elaphe guttata[5]		X		X	
*Elaphe triaspis[5]		X			
Ficimia olivacea[5]		X			
Geophis latifrontalis[4,5]			X		
Geophis multitorques[5]	X				
Gyalopion canum[5]				X	
Hypsiglena (new species)[5]		X			
Hypsiglena torquata[5]				X	
Lampropeltis triangulum[5]	X	X			
*Leptodeira septentrionalis[5]	X	X			
*Leptotyphlops dulcis[6]					X
*Leptotyphlops phenops[5,8]		X			
*Masticophis flagellum[5]		X			
Masticophis taeniatus[5]	X				
Micrurus fulvivus[5]		X			
Oxybelis aeneus[5]		X			
*Pituophis deppei[5,7]			X		X
Rhadinaea crassa[2,5]	X				
Salvadora bairdi[8]					X
Salvadora lineata[5]	X				
Storeria hidalgoensis[5]			X		
Tantilla rubra[5]	X	X			
Thamnophis cyrtopsis[5,7]	X		X		X
Thamnophis eques[1]					X
Thamnophis marcianus[5]	X	X			
Thamnophis melanogaster[1]					X
Thamnophis scalaris[7]			X		
Thamnophis sumichrasti[5]	X				
Toluca lineata[5,7]			X		X
Trimorphodon tau[5]		X		X	
Tropidodipsas sartori[5]	X	X			

is densely covered with pine needles and lacks the abundance of low shrubs found in the El Lobo forest. The pine-oak forest descends to 1800 m. on the east slopes where most of the pine is then replaced by an oak forest. The western slopes are drier, with a vegetation of cacti and thorn scrub present to 2000 m., replaced by an oak forest from

2000–2300 m. and a pine-oak forest ranges from 2300 m. to the crest of the transect line at 2600 m. Much of the area which had been cleared for corn production is being re-seeded to pine by the federal forest station at Amoles. The more open areas being re-seeded contain secondary growths of low grasses and numerous holly-like shrubs. Cretaceous limestone outcrops are common throughout the area.

The Pena Blanca area consists of desert vegetation with a small gallery forest of trees confined to the banks of the Río Extoras. A few stunted mesquite (*Prosopis* sp.) and acacia (*Acacia* sp.) trees are found along the arroyos. Cacti, leather plant (*Jatropha*), acacia and lechiguilla-like plants are scattered throughout the hillsides. The gallery forest is composed of willows, mesquite and acacia. There is an abundance of shale-like rock and the area is a prime source of mercury for the state. The river lies at 1350 m. and the ocotillo-acacia-cacti plant community rises up the eastward slope to an elevation of about 2000 m. whre it gives way to a madroño-oak community. The area west of the Río Extoras is essentially one of rolling hills predominantly covered with desert vegetation to the edge of the Plateau.

The Cadereyta area lies on the Mexican Plateau and lacks the Chihuahuan vegetation of the Pena Blanca area. The predominant cactus is a large tree-like prickly pear (*Nopalea* sp.), and the few trees present are mesquite and oak. This area of the plateau is overgrazed, overfarmed, and generally abused to the extent that little topsoil remains. The area is higher (2000–2100 m) and flatter than the Pena Blanca region, and the soils are a mixture of limestone and volcanic material.

REMARKS. Some of the more perplexing taxonomic problems involve the salamander genus *Pseudoeurycea*, and the lizard genera *Eumeces*, *Lepidophyma*, and *Sceloporus*.

Pseudoeurycea cephalica—Taylor and Smith (1945) described *Pseudoeurycea cephalica rubrimembris* from specimens collected at an elevation of 1372m. in northern Hidalgo, Mexico. Two other subspecies are recognized, *P. c. cephalica* from the Mexican states of Veracruz, Puebla, Mexico and Morelos and *P. c. manni* from southern Hidalgo, Mexico. Taylor and Smith (1945) distinguished *P. c. rubrimembris* from the other forms of *P. cephalica* by the presence of red on the tip of the tail and on the greater portion of the hind limbs, and the fingers and toes touching when the limbs are adpressed. The vomerine tooth count of Taylor and Smith's (1945) sample was 28–46

(M = 34.0). *Pseudoeurycea c. manni* is distinguished from *P. c. cephalica* by adpressed limbs failing to meet by two coastal folds, fingers of the anterior limb reaching the posterior part of eye, the body flecked or clouded with white, especially on the venter, and a vomerine tooth count of 18–30 (M = 23.7); in *P. c. cephalica* the adpressed limbs fail to meet by less than two costal folds, light flecks are lacking on the venter, and the vomerine teeth number 26–32 (M = 27.0). Trufelli (1954) found the mental hedonic gland of *P. c. cephalica* to be circular and regular in diameter while that of *P. c. ruberimembris* was broadly oval and irregular. In addition we found that the hedonic gland of *P. c. manni* is similar to that of *P. c. ruberimembris*.

Pseudoeurycea cephalica taken from the El Lobo and Pinál de Amoles areas have varying amounts of light flecks on the venter. The amount of overlap of adpressed limbs varied from a distinct overlap to complete separation by 1 to 1.5 costal grooves. Two specimens taken from the Pinál de Amoles area have large amounts of red on the dorsum, tail and thighs. The majority of specimens from both areas show varying amounts of red present on the tail and dorsum, but in a few the red is absent. The vomerine tooth count averages 33.5 for both populations and approaches the average of *P. c. rubrimembris*, 34.0.

Measurements of the mental hedonic gland and vomerine tooth counts of specimens from the El Lobo and Pinal de Amoles area indicate a close relationship with *P. c. rubrimembris*. The discovery of color polymorphism in Querétaro samples eliminates color pattern as a character that will separate *P. c. rubrimembris* from *P. c. manni*. However, the disparity in the mean number of vomerine teeth between the two races is a useful character for recognizing each subspecies.

Sceloporus jarrovi—A topotypic series (78) of *Sceloporus jarrovi erythrocyaneus* was taken from the Cadereyta area and compared to populations of *Sceloporus jarrovi* from the Pinál de Amoles and El Lobo areas. Femoral pore counts decrease along a northeast gradient from Cadereyta to Pinál to El Lobo, averagoing 28.1, 27.9, and 23.9 respectively. The average number of dorsal scales decreases, from 47.7 at Cadereyta, 44.9 at Pinal and 42.4 at El Lobo. The average number of scales around midbody were the same for the Cadereyta and Pinal populations (47.5) and slightly higher (48.8) for specimens from El Lobo. Colomorphic variation in all three populations is similar.

Chrapliwy (1964) designated the Pinal de Amoles population as representing intergrades between *S. j. minor* and *S. j. immucronatus.* The dorsal scale counts of our sample (179) from Pinál average higher (44.9) than those given in Chrapliwy's (1964) data for *S. j. minor* populations (41.0) and for the *S. j. minor* x *S. j. immucronatus* intergrades (40.7). The close similarities between the Pinál and Cadereyta populations indicate that the former is a disjunct *S. j. erythrocyaneus* population, rather than an intergrading population between *S. j. minor* and *S. j. immucronatus*.

Chrapliwy (1964) states that *S. j. immucronatus* ranges continuously along the easternmost front of the Sierra Madre Oriental from southern Tamaulipas to northern Hidalgo. He cites average femoral pores and dorsal scale rows for Tamaulipan *S. j. immucronatus* as 33.1, and 40.7, and Hidalgoan counts for *S. j. immucronatus* as 30.8 and 41.1 respectively. Our sample (43 from El Lobo) has a mean femoral pore count of 23.9, and a mean dorsal scale row count of 42.4. Our figures do not confirm an expected north-south cline in *S. j. immucronatus*, and geographic contacts between *S. j. immucronatus* and the El Lobo population do not exist. The difference in the mean number of femoral pores between the El Lobo sample and the *S. j. erythrocyaneus* of Pinál and Cadereyta is not as clinal as expected. Nevertheless the El Lobo *S. jarrovi* appear more closely related to *S. j. erythrocyaneous* in other characters examined, and we regard them as a third disjunct population of that geographic race.

Eumeces tetragrammus—One specimen of *E. tetragrammus* was taken from a dry oak forest at 1075 m. near the El Lobo area, and two from thorn scrub, 675 m., in the Jalpan valley. The former locality is the highest known elevation recorded for the species. Our specimens are typical for the species, with all scale counts within the variation given by Taylor (1935, 1952) and Darlington and Smith (1954). The latter authors mentioned a pattern difference between specimens of *E. tetragrammus* from northern Veracruz and Tamaulipas, and those from southern Texas and southwest Tamaulipas. They indicate that the lateral dark stripe is two and two half scale rows wide in Veracruz and central Tamaulipan specimens, and one and two half scale rows wide in samples from southern Texas and southwestern Tamaulipas. An examination of this character in 27 specimens from Brownsville, Texas, 13 from western Tamaulipas and

3 from Queretaro, Mexico, indicate that the narrow lateral band is present in about 5% of each sample. Therefore, the width of the lateral dark band does not appear to be of diagnostic value in separating populations of *E. tetragrammus.*

Eumeces lynxe—Populations of *E. lynxe* occur in the El Lobo and Pinál areas, and attempts to allocate the specimens to a subspecies by using Webb's (1968) population analysis of this species has been difficult. Webb records what he considers five examples of intergrades between *E. lynxe lynxe* and *E. lynxe belli* from southern San Luis Potosí. Four of these, three from Cerro Conejo, and one from northeast of Xilitla, are geographically very colse to the El Lobo area of Querétaro. The fifth specimen from 6 mi. W of Ahuacatlan, San Luis Potosí, and the specimen recorded as *E. lynxe belli* (= *E. l. lynxe*) from 14 mi. ENE of Landa de Matamoros, Querétaro, (5,400 ft) are within the El Lobo area. The nearest record of *E. l. belli* recorded by Webb (1968) is 16 mi. W of Milpillas, western Zacatecas.

Webb's (1968) key characters for separating the two subspecies first involves the dorsal coloration of the head. Black heads that contrast with the color of the dorsum are given as a *E. lynxe belli* character while brown, non-contrasting heads are typical of *E. l. lynxe.* Clutches of well developed embryos from two adult females of *E. l. lynxe* from Huauchinango, Hidalgo, revealed that all embryos have brownish-black heads that contrast with the color of the dorsum. Webb (1968) indicated that hatchlings of *E. l. lynxe* have black heads, but that the heads of both sexes turn brown towards maturity. In our Pinál and El Lobo specimens, variation in head coloration is apparently a function of ontogenetic change only in males. Adult females and all juveniles have black heads, while aging males gradually develop a brownish head color. Webb considered lateral band development to be significant, but our specimens were highly variable in this regard, including pattern disappearance in old males. Another character involved the development of a light middorsal stripe that bifurcates on the frontal scale in *E. l. lynxe*, but terminates on the frontal in *E. l. belli. The E. l. lynxe*-type stripe bifurcation was present in 29% of the El Lobo sample and 43% of the Piná sample. In one clutch of eight *E. l. lynxe* embryos from Huachinango, Hidalgo, complete bifurcation of the middorsal line occurred in five, only on one side in two, and terminated on the frontal in one.

According to Webb (1968) the size of the last two supralabials differs between the subspecies. *Eumeces l. lynxe* has the seventh supralabial larger than the sixth, while they are sub-equal or conversely related in *E. l. belli*. In 10 El Lobo and Pinál specimens under 45 mm. in snout-vent length (SVL), the frequency of the seventh supralabial being larger than the sixth was 40%. In 13 adults between 52–60 mm SVL, the frequency was 76.9% (71% in seven males). In 14 adults over 61 mm SVL, the frequency of the seventh supralabial being larger than the sixth was 82.1% (100% in six males). Of 12 embryos from female Hidalgoan *E. l. lynxe* the sixth and seventh supralabial were equal in size in 50%, sixth largest in 4%, and seventh largest in 46%. In our sample this character seems to be a function of ontogenetic change. The changein supralabial size perhaps occurs to accommodate the increasing development of the masseter muscle with age, especially in males.

Webb (1968) gives the average dorsal scale counts of *E. l. lynxe* as 56.2, while in *E. l. belli* the average is 61.2. The El Lobo sample averaged 56.0 and the Pinál sample 58.8. Of the El Lobo sample, only 8% of the dorsal scale counts were above 60, while 33% were above 60 for the Pinál sample. Our specimens are from near the area of intergradation of the two subspecies, where one would expect variation. We regard the eastern Querétaro sample as a dark-headed population of *E. l. lynxe*, with the Pinál sample showing strong tendencies towards *E. l. belli*.

Lepidophyma gaigeae—The population of *Lepidophyma gaigeae* from the El Lobo area has squamation typical for the species, but is isolated from the population occupying the highlands in the Mexican state of Hidalgo by the valley of the Río Moctezuma. Of 209 specimens, only one was taken from a habitat outside of limestone crevices in pine-oak forests. It was found on a plastered adobe wall of a building in a thorn scrub forest, north of the Río Santa Maria, 600 m. In the remarks section of Taylor's (1939) original description of *L. sylvatica*, he indicated that only one of a 100 specimens of *L. gaigeae* was found outside of a "limestone environment."

Of 111 female *L. gaigeae* none were found with oviducal embryos during the months of December, June, August, and September. In January, five females contained early embryonic yold masses in their oviducts. B. C. Brown (pers. comm.) indicated that a female taken in December gave birth to one young in early March.

The sex ratio of *L. gaigeae* varies from 23% males in a sample taken in January, to 50% males in a sample taken in July. Of 209 individuals taken over a five month period, 40.6% of the total sample were males.

Lepidophyma flavimaculatum—Our sample of 28 specimens of *L. flavimaculatum* from the El Lobo and Jalpan areas appears to represent two distinct species. Our sample of *Lepidophyma flavimaculatum* from the El Lobo area is nearly identical with *L. f. tenebrarum* from Tamaulipas in most of the major scale features. However, our specimens from the Jalpan valley are not only different in major scale features but also occupy a vastly different habitat. The two samples are geographically separated by a distance of 22 km. Scales around the body, excluding the ventral plates, average 51.0 for the Jalpan series, 39.8 for the El Lobo sample, with no overlap at the extremes. Femoral pores average 20.1 for the Jalpan sample and 26.9 for El Lobo. The number of gular scales average 64.0 for Jalpan and 48.2 for the El Lobo sample. The number of granules from the rear of the head to the base of the tail average 185.5 for the Jalpan sample and 163.6 for El Lobo. The specimens from the Jalpan area were taken from arid tropical scrub beneath stones in a caliche quarry and the El Lobo sample came from a pine-oak forest, beneath rotting logs and in crevices of limestone outcrops. *Lepidophyma smithi* is apparently a valid species and represents our Jalpan sample. All populations of *L. smithi* have low femoral pore counts and occupy rock habitats in thorn scrub communities.

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