

COMPARISON OF LIFE HISTORY CHARACTERISTICS AMONG
SYNTOPIC ASSEMBLAGES OF PARTHENOGENETIC SPECIES: TWO
COLOR PATTERN CLASSES OF *ASPIDOSCELIS TESSELATA*, *A. EXSANGUIS*,
A. FLAGELLICAUDA, AND THREE COLOR PATTERN CLASSES OF
A. SONORAE (SQUAMATA: TEIIDAE)

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ABSTRACT—Four syntopic assemblages of parthenogenetic lizards were compared for differences in body size at which reproductive maturity is attained and mean clutch size: 1) *Aspidoscelis flagellicauda* and *A. exsanguis* from the vicinity of San Francisco Hot Springs (type locality of *A. flagellicauda*), Catron and Grant counties, New Mexico; 2) *A. flagellicauda* and *A. sonorae* from the vicinity of Oracle, Pinal County, Arizona (type locality of *A. sonorae*); 3) *A. sonorae* (3 color pattern classes) from the vicinity of Cochise Stronghold, Cochise County, Arizona; and 4) *A. sonorae* (2 color pattern classes) from the vicinity of Parker Canyon Lake, Cochise County, Arizona. Reproduction begins at a smaller body size in *A. exsanguis* (61 mm SVL) than in *A. flagellicauda* (70 mm SVL). This results in a higher population density in *A. exsanguis*, despite the larger mean clutch size in *A. flagellicauda* (3.7 vs. 3.3 eggs). *Aspidoscelis sonorae* and *A. flagellicauda*, although morphologically distinguishable, were not significantly different in size at reproductive maturity or mean clutch size, which was also true for the color pattern classes of *A. sonorae*.

RESUMEN—Cuatro ensambles sintópicos de lagartijas partenogénicas fueron comparados para encontrar las diferencias en tamaño corporal al alcanzar la madurez sexual y en tamaño promedio de la nidada: 1) *Aspidoscelis flagellicauda* y *A. exsanguis* del área de San Francisco Hot Springs (localidad tipo de *A. flagellicauda*), condados de Catron y Grant, Nuevo México; 2) *A. flagellicauda* y *A. sonorae* del área de Oracle, condado de Pinal, Arizona (localidad tipo de *A. sonorae*); 3) *A. sonorae* (3 patrones de coloración corporal) del área de Cochise Stronghold, condado de Cochise, Arizona; y 4) *A. sonorae* (2 patrones de coloración corporal) del área de Parker Canyon Lake, condado de Cochise, Arizona. La reproducción comienza a un tamaño corporal menor en *A. exsanguis* (61 mm longitud hocico-cloaca, LHC) que en *A. flagellicauda* (70 mm LHC). Esto resulta en una población más densa de *A. exsanguis* a pesar de un tamaño promedio de nidada más grande en *A. flagellicauda* (3.7 vs. 3.3 huevos). *Aspidoscelis sonorae* y *A. flagellicauda*, aunque morfológicamente distintas, no son significativamente diferentes en tamaño corporal de madurez sexual ni en el tamaño promedio de la nidada. Lo mismo se presentó entre los patrones de coloración corporal de *A. sonorae*.

Variation in life history characteristics would not be unusual in a sympatric assemblage of bisexual species, but different life history characteristics in a local population of a parthenogenetic species is of interest as evidence of evolutionary divergence in a clonally reproducing entity. An example of this phenomenon involves 2 color pattern classes of *Aspidoscelis tessellata* (= *Cnemidophorus tessellatus* of Walker et al., 1997) coexisting in the same habitats at Sumner Lake State Park, De Baca County, New Mexico (Taylor et al., 1997, 2000). (We use *Aspidoscelis* rather than *Cnemidophorus* for this genus, following Reeder et al., 2002.)

Color pattern variation in *A. tessellata* is currently partitioned into 4 color pattern classes: C, Colorado D, New Mexico D, and E (Zweifel, 1965; Taylor et al., 1996; Walker et al., 1997). At Sumner Lake State Park, gravid females of pattern classes C and E differ significantly in 2 life history attributes: mean snout-vent length (C: 93.4 mm; E: 85.1 mm) and mean clutch size (C: 4.24 eggs; E: 3.24 eggs) (Taylor et al., 1997, 2000). Because of this reproductive differential, pattern class C would be expected to be more numerous at this locality (Taylor et al., 2000), but random samples contained equivalent numbers of the 2 pattern classes,

suggesting that they occurred at equivalent densities. Resolving the paradox of unequal clutch sizes and equal densities involved the difference in snout-vent length (SVL) at which reproductive maturity was attained: 88 mm in C, 70 mm in E. Evidently, certain individuals of pattern class E began reproducing a year earlier than individuals of pattern class C, thereby compensating for smaller clutches. In summary, pattern classes C and E at Sumner Lake differ in 1) size at which reproductive maturity is attained, mean SVL of gravid females, mean clutch size, and maximum SVL (Taylor et al., 1997, 2000) and 2) meristic morphological characters (Taylor et al., 2003).

Aspidoscelis sonorae is another parthenogenetic species with color pattern variation that lends itself to classification into adult color pattern classes. The purpose of this study was to determine 1) whether syntopic color pattern classes of *A. sonorae* differed in reproductive characteristics, as found in *A. tessellata* at Sumner Lake State Park and 2) whether different syntopic pairs of parthenogenetic species—*A. sonorae* and *A. flagellicauda*; *A. exsanguis* and *A. flagellicauda*—differed in these characteristics. Studies focusing on other aspects of the reproductive biology of *A. sonorae* include Echternacht (1967 [the population studied was then allocated to *A. exsanguis*]) and Routman and Hulse (1984). Stevens (1980) provided the same focus for *A. flagellicauda*.

Aspidoscelis flagellicauda and *A. sonorae* were described by Lowe and Wright (1964) and compared to the superficially similar *A. exsanguis*. Unfortunately, the diagnoses for these species are inadequate (Dessauer and Cole, 1989), and the stated intent of the original authors to describe intraspecific variation in these species has not materialized. However, color pattern classes in *A. sonorae* from Arizona and New Mexico were alluded to as 3 undescribed species (C. “sp. C”; C. “sp. O”; and C. “sp. S”) by Densmore et al. (1989), and different color patterns in *A. sonorae* were illustrated by Dessauer and Cole (1989, their Figs. 2 and 3).

Individuals of *Aspidoscelis sonorae*, *A. flagellicauda*, and *A. exsanguis* attain reproductive maturity prior to completing color pattern ontogeny. However, representatives of *A. exsanguis* can be distinguished from those of *A. flagellicauda* and *A. sonorae* regardless of size. An example of an adult *A. exsanguis* is illustrated by

Lowe and Wright (1964, their Fig. 1), and color pattern ontogeny in *A. exsanguis* is shown by Dessauer and Cole (1989, their Fig. 4). Unlike *A. exsanguis*, only individuals >77 mm SVL could be assigned confidently to either *A. flagellicauda* or *A. sonorae* and to color pattern class for the latter species. Individuals not meeting this size criterion were grouped as “SVL <78 mm.”

Individuals were collected (barring escapes) as they were encountered in the field; specific information on samples and sample localities is provided in Appendix 1. Parametric statistical tests were used for comparisons when samples had normal distributions and homogeneous variances; tests adjusted for unequal sample variances were used when the latter assumption was not met. The conservative Tukey-Kramer multiple comparison test was used to reveal specific differences among sample means when probabilities from analyses of variance were <0.05. A few individuals with either internal damage sufficient to preclude an accurate assessment of gravidity or aberrant reproductive organs (sterile) were not included in the figures. SYSTAT 10.2 (Systat Software, Inc., Richmond, California) and NCSS (Hintze, 2001) software were used for the analyses.

We used the name *A. flagellicauda* for certain individuals collected near San Francisco Hot Springs, the type locality, and at the Oracle site, where *A. flagellicauda* and *A. sonorae* are sympatric (Lowe and Wright, 1964). The adult color pattern of *A. flagellicauda* is exemplified by the holotype (Lowe and Wright, 1964, their Fig. 1), with relatively few pale spots being the principal feature of the adult pattern. Other representatives of *A. flagellicauda* are shown by Dessauer and Cole (1989, their Figs. 2C, E, and 3D), and juvenile-to-adult color pattern ontogeny is described and illustrated by Taylor and Ranck (1984, their Fig. 1).

We used the name *A. sonorae* for individuals exhibiting the color pattern of the holotype of *A. sonorae* (Lowe and Wright, 1964, their Fig. 1), with numerous pale spots being the fundamental feature in adults. Another example of this color pattern is provided by Dessauer and Cole (1989, their Fig. 2F). Two other color patterns occurred in populations of *A. sonorae*. One pattern was superficially similar to *A. flagellicauda* in having a low number of pale spots. This pattern was found in populations located

south of the range of *A. flagellicauda* (as mapped in Wright and Lowe, 1968, their Fig. 2). We used the provisional designation “few spots” to refer to this color pattern class in samples from Cochise Stronghold and Parker Canyon Lake, both in Cochise County, Arizona. A second pattern, “indistinct spots,” comprised individuals > 77 mm SVL that lacked distinct pale spots in the dorsal pattern (Desauers and Cole, 1989, their Fig. 2B). This pattern also was expressed by certain individuals of *A. flagellicauda*.

Three features were consistent within all taxa and color pattern classes at all sampling localities: 1) clutch size estimates from vitellogenic ovarian follicles and oviductal eggs were not significantly different (all $P \geq 0.16$), enabling us to pool estimates from the 2 sources into 1 clutch variable; 2) mean clutch size did not differ significantly across the years sampled (all $P \geq 0.05$); and 3) there was a significant positive relationship between clutch size and SVL (all $P \leq 0.0001$; all $R^2 \geq 0.36$). The reproductive characteristics of each of 4 assemblages are described below. The “SVL < 78 mm” group was excluded from statistical comparisons because 1) it could contain a mixture of individuals that would have developed different final color patterns, and 2) it comprised the smallest reproductive individuals at each locality, thereby superimposing unnaturally small clutch estimates on an artificial group.

Site 1 was located at San Francisco Hot Springs, Catron County, New Mexico, the type locality of *A. flagellicauda*, and 2 nearby localities, South Dugway Canyon, also in Catron County, and Little Dry Creek, Grant County, New Mexico. Samples were collected 22 through 24 June 1995; 12 through 13 June 1996; and 4 through 6 July 1997. *Aspidoscelis flagellicauda* and *A. exsanguis* were syntopic at all 3 localities. In addition to *A. exsanguis*, 5 individuals of the “indistinct spots” pattern and 7 individuals of “typical” *A. flagellicauda* were collected at the Little Dry Creek site in 1996. The “indistinct spots” pattern was not collected at Little Dry Creek in 1997, and it was not found in samples from San Francisco Hot Springs and South Dugway Canyon. Gravid females of *A. flagellicauda* and “indistinct spots” were similar in SVL ($t_{13} = 0.105$, $P = 0.92$) and mean clutch size ($t_{13} = -1.501$, $P = 0.16$).

Gravid individuals of *A. flagellicauda* were sig-

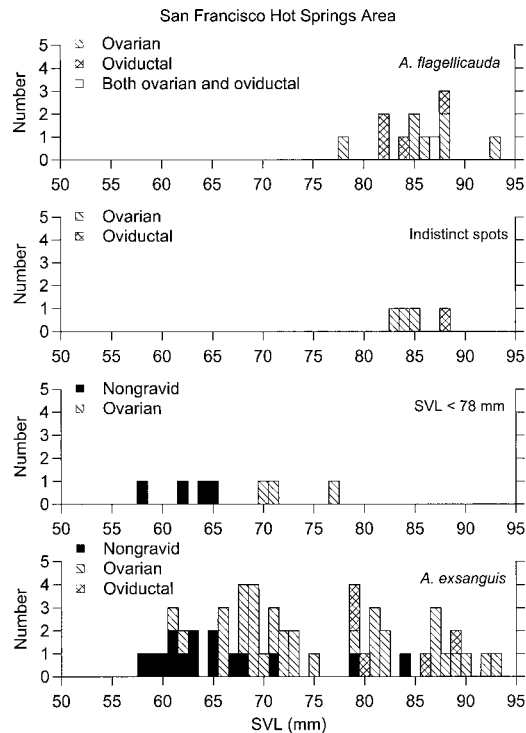


FIG. 1.—Frequency distribution of body size (SVL) and reproductive status of individuals among 4-group assemblage of *Aspidoscelis exsanguis* and *A. flagellicauda* from the vicinity of San Francisco Hot Springs, Catron and Grant counties, New Mexico.

nificantly larger than those of *A. exsanguis* (Aspin-Welch $t_{45.19} = 4.384$, $P < 0.0005$) (Table 1, Fig. 1) and produced a significantly larger mean clutch (Aspin-Welch $t_{38.19} = 2.268$, $P = 0.03$). However, *A. exsanguis* outnumbered *A. flagellicauda* at all 3 sampling localities, which might reflect reproductive maturity being achieved at 61 mm SVL in *A. exsanguis* and 70 mm SVL in *A. flagellicauda* (Fig. 1). Because each species exhibited the same maximum SVL of 93 mm (Fig. 1), the disparity in age of reproductive maturity should have provided *A. exsanguis* with a greater reproductive potential.

Site 2 was located 2.7 km SE Oracle, Pinal County, Arizona, only a few kilometers from the type locality of *A. sonorae* (Lowe and Wright, 1964; 3.2 km SW Oracle). Samples were collected 7 through 10 July 1995; 16 through 17 June 1996; and 11 July 1997. In contrast to *A. flagellicauda* and *A. exsanguis* from Site 1, gravid females of *A. sonorae* and *A.*

TABLE 1—Descriptive statistics for clutch size and snout-vent length (SVL) of gravid individuals from 4 assemblages of parthenogenetic *Aspidoscelis flagellicauda* and *A. exsanguis*, and color-pattern classes of parthenogenetic *A. sonora*. Means are shown with $\pm SE$ and range limits.

Locality	SVL (mm)	Clutch size
Taxon and sample size		
San Francisco Hot Springs area		
<i>A. flagellicauda</i> *, $n = 11$, $n = 12$	84.8 \pm 0.95 (78–88)	3.7 \pm 0.28 (1–5)
Indistinct spots, $n = 4$	85.0 \pm 1.08 (83–88)	3.5 \pm 0.29 (3–4)
<i>A. exsanguis</i> , $n = 38$	77.1 \pm 1.47 (61–93)	3.3 \pm 0.25 (1–7)
Oracle		
<i>A. sonora</i> , $n = 7$	84.1 \pm 0.63 (81–86)	2.7 \pm 0.61 (1–5)
<i>A. flagellicauda</i> , $n = 5$	84.2 \pm 0.73 (82–86)	4.4 \pm 0.24 (4–5)
Indistinct spots, $n = 1$	78	3
SVL < 78 mm, $n = 7$	71.3 \pm 0.99 (67–75)	2.4 \pm 0.20 (2–3)
Cochise Stronghold		
<i>A. sonora</i> , $n = 6$	89.8 \pm 0.75 (88–93)	3.3 \pm 0.33 (2–4)
Few spots, $n = 21$	85.9 \pm 0.71 (78–92)	3.6 \pm 0.19 (2–5)
Indistinct spots, $n = 5$	81.8 \pm 0.86 (80–85)	3.4 \pm 0.40 (2–4)
SVL < 78 mm, $n = 19$	74.1 \pm 0.60 (69–77)	1.9 \pm 0.14 (1–3)
Parker Canyon Lake		
Few spots, $n = 6$	83.3 \pm 0.95 (81–87)	4.7 \pm 0.42 (4–6)
Indistinct spots, $n = 8$	81.2 \pm 0.88 (78–84)	3.6 \pm 0.38 (2–5)
SVL < 78 mm*, $n = 13$, $n = 14$	72.2 \pm 1.12 (63–77)	2.5 \pm 0.34 (1–5)

* 1 individual with evidence of 2 clutches.

flagellicauda from Oracle did not differ significantly in either SVL ($t_{10} = -0.059$, $P = 0.95$) or in mean clutch size ($t_{10} = -2.232$, $P = 0.05$) (Table 1, Fig. 2). A single representative of the “indistinct spots” pattern class (RU 97118) was 78 mm in SVL and had a clutch of 3 oviductal eggs. The 2 populations of *A. flagellicauda* from the Oracle and San Francisco Hot Springs sites were similar in SVL of gravid females ($t_{15} = 0.543$; $P = 0.59$) and clutch size ($t_{15} = -0.648$, $P = 0.53$).

Site 3 was the vicinity of Cochise Stronghold, Cochise County, Arizona, where 3 color pattern classes of *A. sonora* coexist. Samples were collected 29 June through 1 July 1995 and 8 through 9 July 1997. Each of the 3 color pattern classes was significantly different in SVL of gravid females ($F_{2,29} = 10.50$, $P = 0.0004$; Table 1, Fig. 3), but clutch sizes were not significantly different ($F_{2,29} = 0.33$, $P = 0.72$).

Site 4 represented 2 geographically proximate collecting localities at the northeastern end of Parker Canyon Lake, Cochise County, Arizona. Samples were collected 5 through 8 June 1972; 3 through 4 July 1995; 18 June

1996; and 12 through 13 July 1997. These samples were pooled because 1972 and 1995 through 1997 samples were neither significantly different in SVL of gravid females ($t_{26} = 0.418$, $P = 0.68$) nor in mean clutch size ($t_{26} = 0.118$, $P = 0.91$). Gravid females of the 2 pattern classes at this locality, “few spots” and “indistinct spots”, were similar in SVL ($t_{12} = -1.588$, $P = 0.31$) and clutch size ($t_{12} = -1.838$, $P = 0.09$) (Table 1, Fig. 4).

There is sufficient evidence for a hypothesis to explain the color pattern classes in *A. sonora* and *A. flagellicauda*. The “indistinct spots” pattern was expressed in both *A. flagellicauda* and *A. sonora*. This pattern is found early in the color pattern ontogeny of both species, and, in adults, it might represent an interruption of color pattern development (see below). Samples of *A. sonora* from the vicinity of Parker Canyon Lake area document the persistence of the “indistinct spots” pattern from 1972 through 1997. Although this pattern was expressed by large individuals from 3 of the 4 localities, it was most common at Parker Canyon Lake.

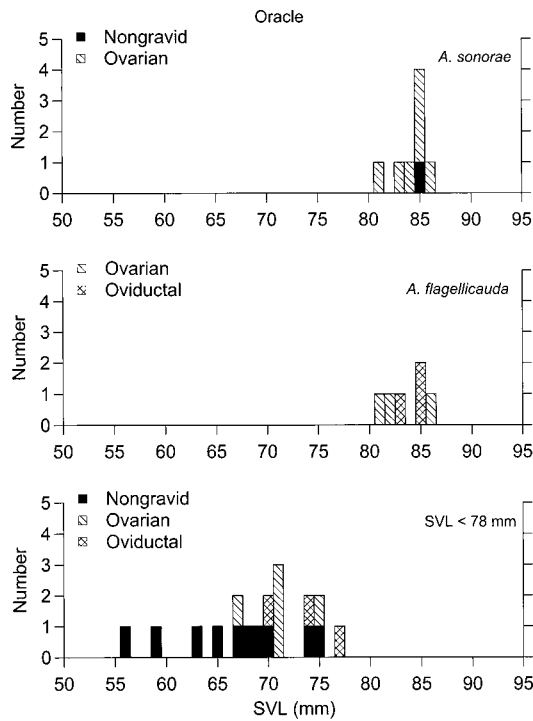


FIG. 2.—Frequency distribution of body size (SVL) and reproductive status of individuals among 3 members of 4-group assemblage of *Aspidoscelis sonoreae* and *A. flagellicauda* from the vicinity of Oracle, Pinal County, Arizona. Single “indistinct spots” individual of 78 mm SVL, with a clutch of 3 eggs, was not included in the figure.

At Cochise Stronghold, there was a progression in mean SVL (Fig. 3), from “indistinct spots” (82.0 mm) to “few spots” (85.3 mm) to the profuse spotting of the *A. sonoreae* pattern (89.8 mm). This sequence mirrors ontogenetic color pattern development in this species; therefore, the “indistinct spots” and “few spots” patterns might be expressions of intermediate stages, which could also be genetically fixed in some populations (C. J. Cole, H. L. Taylor, H. C. Dessauer, and J. E. Cordes; work in progress).

The striking differences in SVL and clutch size between 2 color pattern classes of *A. tessellata* at Sumner Lake State Park were not exhibited by the color pattern classes of *A. sonoreae*. These differences also were missing between *A. flagellicauda* and the color pattern classes of *A. sonoreae* at the Oracle locality (Fig. 2). However, 2 syntopic parthenogenetic species in the vicin-

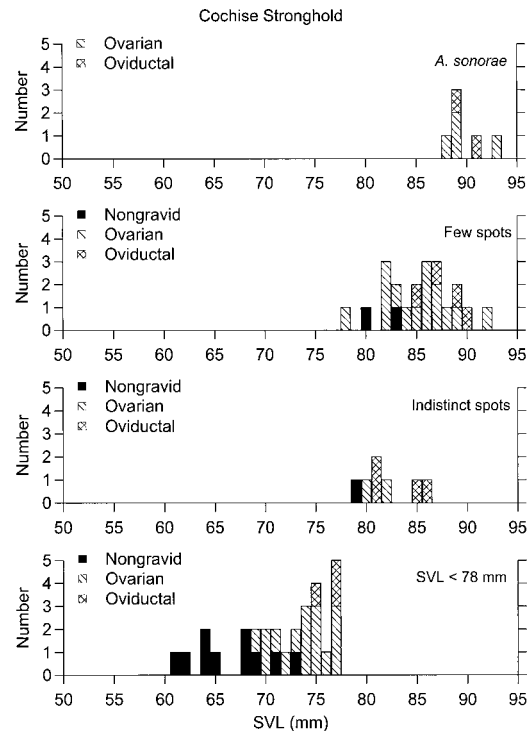


FIG. 3.—Frequency distribution of body size (SVL) and reproductive status of individuals among 4-group assemblage of *Aspidoscelis sonoreae* from Cochise Stronghold, Cochise County, Arizona.

ity of San Francisco Hot Springs had reproductive characteristics similar to those of pattern classes C and E of *A. tessellata* at Sumner Lake. Pattern class C of *A. tessellata* was similar to *Aspidoscelis flagellicauda* in having a larger mean clutch, and pattern class E of *A. tessellata* was similar to *Aspidoscelis exsanguis* in attaining reproductive maturity at a smaller SVL. The similarities end with respect to relative numbers of individuals; unlike similar numbers of pattern classes C and E at Sumner Lake, individuals of *A. exsanguis* outnumbered those of *A. flagellicauda* at all sites of syntopy.

This study reveals the presence of alternate pathways for the evolution of life history characteristics in parthenogenetic entities. Whereas all populations of *A. tessellata* can be traced back to a single F₁ hybrid zygote (Maslin, 1967; Cordes and Walker, 2003), the differences between *A. flagellicauda* and *A. exsanguis* hinge on different genealogies. *Aspidoscelis exsanguis* was derived from the mating of an *A. burti sticto-*

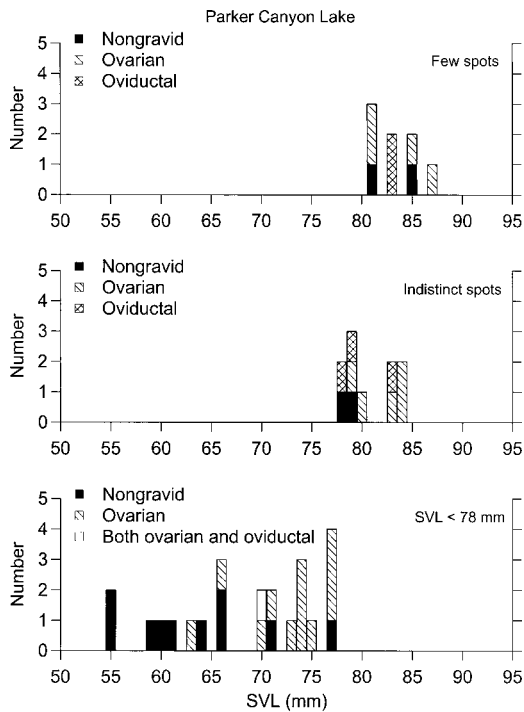


FIG. 4—Frequency distribution of body size (SVL) and reproductive status of individuals among 3-group assemblage of *Aspidoscelis sonorae* from the vicinity of Parker Canyon Lake, Cochise County, Arizona.

gramma × *A. inornata* hybrid with a male of *A. gularis scalaris*, whereas *A. flagellicauda* was derived from an *A. burti stictogramma* × *A. inornata* hybrid that backcrossed to a male *A. burti stictogramma* (Reeder et al., 2002). Other taxonomic interpretations of the hybridization participants are provided by Good and Wright (1984), Densmore et al. (1989), Dessauer and Cole (1989), and Moritz et al. (1989). Different life history characteristics in 2 color pattern classes of the same parthenogenetic species (*A. tessellata*) resemble those seen in 2 parthenogenetic species (*A. flagellicauda* and *A. exsanguis*). Evidently, random de novo mutations can occasionally initiate phenotypic divergence equivalent to that produced by different hybridization events. Clonal reproduction can then increase the mutations responsible for the divergence (Dessauer and Cole, 1986). These comparisons support the idea that the absence of genetic recombination does not preclude the acquisition of new ad-

aptations in parthenogenetic entities (Parker and Selander, 1976).

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APPENDIX 1

Specimens Examined—Locality 1—New Mexico, Catron County, San Francisco Hot Springs, approximately 8 km S Glenwood Post Office on US Highway 180, then west to San Francisco River. *Aspidoscelis flagellicauda*: 5 and 6 July 1997: Regis University (RU) 9773–9775. *Aspidoscelis exsanguis*: 5 and 6 July 1997: RU 9771, 9772, 9776–9784. New Mexico, Catron County, South Dugway Canyon, approximately 10.5 km S of Glenwood Post Office, east side of US Highway 180. *Aspidoscelis flagellicauda*: 22–24 June 1995: RU 9570–9574, 9580, 9586, 9589, 9591, 9592. *Aspidoscelis exsanguis*: 22–24 June 1995: RU 9562–9569, 9576–9579, 9581, 9582, 9584, 9585, 9587, 9588, 9590. New Mexico, Grant County, north side Little Dry Creek, approximately 18.8 km S of Glenwood Post Office, 1.9 km E of US Highway 180 on Forest Service Road 147 (Sacaton Road). *Aspidoscelis flagellicauda*: 12 and 13 June 1996: RU 9665, 9666, 9675. 4 July 1997: RU 9751–9754, 9762. “Indistinct spots”: 12 and 13 June 1996: RU 9663, 9664, 9672–9674. *Aspidoscelis exsanguis*: 22 June 1995: RU 9560; 12 and 13 June 1996: RU 9667–9670, 9676–9683; 4 and 5 July 1997: RU 9755–9760, 9763–9770.

Locality 2—Arizona, Pinal County, 2.7 km SE of Oracle on Mount Lemmon Road (from junction with American Avenue in Oracle). *Aspidoscelis sonora*: 7–10 July 1995: RU 95157, 95158, 95164, 95171–95173; *A. flagellicauda*: RU 95159, 95161, 95175; “SVL <78 mm”: RU 95160, 95162, 95163, 95165–95169, 95174. 16 and 17 June 1996: *Aspidoscelis sonora*: RU 9686, 9691; *A. flagellicauda*: RU 9685, 9692; “SVL <78 mm”: RU 9687–9690, 9693. 11 July 1997: *Aspidoscelis sonora*: RU 97116; *A. flagellicauda*: 97117; “Indistinct-spots”: RU 97118; “SVL <78 mm”: RU 97119–97122.

Locality 3—Arizona, Cochise County, Cochise Stronghold, Dragoon Mountains. 29 June–1 July 1995: *Aspidoscelis sonora*: RU 95111, 95114, 95127; “Few-spots”: RU 95112, 95113, 95115, 95116, 95123–95126, 95135–95138; “Indistinct spots”: RU 95117, 95118; “SVL <78 mm”: RU 95119–95122, 95128–95134, 95139–95144. 8 and 9 July 1997: *Aspidoscelis sonora*: RU 97087, 97088, 97108, 97110; “Few-spots”: RU 97086, 97089–97095, 97109, 97111, 97113; “Indistinct spots”: RU 97085, 97102, 97112; “SVL <78 mm”: RU 97096–97101, 97103–97107, 97114, 97115.

Locality 4—Arizona, Cochise County, Parker Canyon Lake, vicinity of Lakeview Campground and along dirt road north of lake. 5–8 June 1972: “Few-

spots": RU 7224, 7226, 7227; "Indistinct-spots": RU 96095, 96096; "Indistinct-spots": RU 96097, 96098; 7219, 7223, 7225; "SVL <78 mm": RU 7220–7222, "SVL <78 mm": RU 96099–96102. 12 and 13 July 7228. 3 and 4 July 1995: "Indistinct-spots": RU 1997: "Few-spots": 97123–97125, 97130; "Indistinct-spots": RU 97131, 97132, 97134; "SVL <78 mm": 95147, 95148; "SVL <78 mm": 95145, 95146, 95149, 95150, 95152–95154. 18 June 1996: "Few-spots": RU 97133, 97135–97137.

MORPHOLOGICAL CHARACTERISTICS OF A NEWLY DISCOVERED POPULATION OF *ASPIDOSCELIS TESSELATA* (SQUAMATA: TEIIDAE) FROM CHIHUAHUA, MÉXICO, THE IDENTITY OF AN ASSOCIATED HYBRID, AND A PATTERN OF GEOGRAPHIC VARIATION

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ABSTRACT—A population of the parthenogenetic teiid lizard, *Aspidoscelis tessellata*, was recently discovered in the vicinity of Benavides, Chihuahua, México. This population is located in the general area where *A. tessellata* originated, as a parthenogenetically competent F₁ hybrid, from hybridization between *A. tigris marmorata* and *A. gularis septemvittata*. Subsequent to its origin, *A. tessellata* utilized habitats associated with the Rio Grande and Pecos River drainages to expand its range into New Mexico. We used a canonical variate analysis of samples from Chihuahua, México, and the Rio Grande and Pecos River distribution corridors in southern New Mexico to determine the pattern of morphological variation among the 4 populations. The 2 populations from New Mexico were divergent, both from the Chihuahuan populations (which were morphologically similar) and from each other. A male specimen, collected with *A. tessellata* in the Benavides vicinity, was identified as a putative *A. tessellata* × *A. tigris marmorata* hybrid.

RESUMEN—Una población de la lagartija téida partenogenética *Aspidoscelis tessellata*, fue recientemente descubierta en los alrededores de Benavides, Chihuahua, México. Esta población está localizada en el área más o menos donde *A. tessellata* se originó, como un híbrido F₁ partenogenéticamente viable, de la hibridación entre *A. tigris marmorata* y *A. gularis septemvittata*. Subsecuentemente a su origen, *A. tessellata* utilizaba los hábitats asociados con las cuencas del Río Grande y del Río Pecos para extender su distribución a Nuevo México. Utilizamos un análisis de variables canónicas de muestreos de Chihuahua, México, y de los corredores de distribución del Río Grande y del Río Pecos en el sur de Nuevo México para determinar el patrón de variación morfológica entre las 4 poblaciones. Las 2 poblaciones de Nuevo México divergieron tanto de las poblaciones de Chihuahua (las cuales fueron morfológicamente similares) como entre ellas mismas. Un espécimen macho, recolectado con *A. tessellata* en los alrededores de Benavides, fue verificado como un posible híbrido de *A. tessellata* × *A. tigris marmorata*.

An accurate assessment of the ecological and evolutionary success of parthenogenetic vertebrate species requires an accurate inventory of their populations. This is particularly true for those species with highly disjunct distribution patterns, such as *Aspidoscelis tessellata*, a diploid parthenogenetic species extracted from the

"*Cnemidophorus tessellatus*-complex" by Walker et al. (1997). Our use of *Aspidoscelis* is based on Reeder et al. (2002). The population of *A. tessellata* that we report was discovered in 1999 near Benavides, Chihuahua, México (Appendix 1), during a herpetological survey of that state by JAL-E. This species is of special interest

because there is mounting evidence that all of its scattered, divergent clones and populations (extending latitudinally from approximately 28° in northeastern Chihuahua, México to 37°45' in southeastern Colorado) can be traced back to a single, basal parthenogenetic individual (Maslin, 1967; Cordes and Walker, 2003). Therefore, it is an excellent model organism for assessing the evolutionary potential of a parthenogenetic vertebrate (Taylor et al., 2000, 2001).

The newly discovered Benavides population of *A. tessellata* has additional importance because it is located in the region where this species originated from an F₁ hybrid derived from a female of *A. tigris marmorata* and a male of *A. gularis septemvittata* (Neaves, 1969; Parker and Selander, 1976; Dessauer and Cole, 1989; Dessauer et al., 1996). Although the pioneering study by Zweifel (1965) of morphological variation in *A. tessellata* was followed by comprehensive analyses of its genetic variation (Parker and Selander, 1976; Dessauer and Cole, 1989), studies of morphological divergence from the perspective of a single hybridization event have only recently been initiated (Walker et al., 1997 [1998]; Taylor et al., 2000, Taylor et al., 2003). Ultimately, studies of postformational morphological divergence in *A. tessellata* will have to include populations from the geographic region of its origin. Because *A. tessellata* originated relatively recently (Parker and Selander, 1976; Densmore et al., 1989), it is likely that *A. tessellata* originated in a region presently defined by the overlapping geographic ranges of *A. tessellata* and its parental species, *A. tigris marmorata* and *A. gularis septemvittata*, either in the Trans-Pecos region of Texas or in northeastern Chihuahua, México.

The Benavides population of *A. tessellata* is sympatric with both parental species; its geographic location is mapped in Walker et al. (2001, Fig. 1, site SEPT-CMX5). The desert scrub habitat of the Benavides locality is characterized by gravelly and rocky soils dominated by shrubs, including *Larrea tridentata*, *Prosopis glandulosa*, *Acacia constricta*, *Acacia greggii*, *Mimosa biuncifera*, *Celtis pallida*, and *Fouquieria splendens* (Semarnap, 1997). Because the Benavides population is only about 20 km west of the Rio Grande, the nearest populations of *A. tessellata* are in Brewster County, Texas (Punzo, 2001). The closest reported Chihuahuan pop-

ulation of *A. tessellata* is from the vicinity of El Pueblito, near the Rio Conchos and approximately 116 km west of Benavides (Parker and Selander, 1976; Walker et al., 2000).

One purpose of our study was to characterize the morphological variation in the Benavides population in the context of 3 other populations of *A. tessellata* selected for their geographical positions in the range of the species. One of the 3 populations was from the vicinity of Saucillo, Chihuahua, located approximately 182 km southwest of Benavides. The Saucillo population is in the Rio Conchos dispersal corridor and defines the southern range boundary of *A. tessellata* in Chihuahua (Smith et al., 1963; Parker and Selander, 1976). Although this population has not been tested electrophoretically for protein phenotypes, a population of *A. tessellata* from Julimes, located approximately 44 km north of the Saucillo population, was included in a study of genetic variation by Parker and Selander (1976). We also compared the Benavides population to 2 populations of *A. tessellata* from New Mexico, 1 population from each of 2 river basins used by *A. tessellata* in its postformational, northward range expansion (Parker and Selander, 1976; Cuellar, 1977; Degenhardt et al., 1996; *Cnemidophorus grahamii* is used for *A. tessellata* in the latter reference). These 2 sampling localities, Arroyo del Macho in the Pecos River drainage and Engle in the Rio Grande drainage, occur at the same general latitude (Appendix 1), and information on reproductive characteristics (Taylor et al., 2000) and genotypes (Parker and Selander, 1976; Taylor et al., 2001) is available for these populations. In addition, a male with the fundamental color pattern features of *A. tessellata* had been collected with the Benavides sample of this species. Therefore, a second purpose was to verify the hybrid status of this male and determine its genealogy.

We used 9 meristic characters (Appendix 2) to determine the multivariate pattern of variation among the 4 populations of *A. tessellata*. Three of the 9 characters were based on the number of dark transverse bars (regardless of width) that break or disrupt the continuity of the pale primary stripes (laterals = L-breaks, dorsolaterals = DL-breaks, and paravertebrals = PV-breaks). Typically (there is individual variation), the development of a complement of breaks is a component of color pattern chang-

TABLE 1—Descriptive statistics of morphological characters among samples of *Aspidoscelis tessellata*, *A. tigris marmorata*, *A. gularis septemvittata*, and *A. tessellata* × *A. tigris marmorata* hybrids. For each character, numbers in the first row are mean ± SE; numbers in the second row are sample size and range limits. Collection localities are Benavides and Saucillo vicinities, Chihuahua, México; Arroyo del Macho (=Macho), Chaves County, New Mexico; and Engle, Sierra County, New Mexico.

Character ^a	Benavides hybrid	Benavides <i>A. tessellata</i>	Benavides <i>A. gularis</i>	Macho <i>A. tigris</i>	Macho hybrids	Saucillo <i>A. tessellata</i>	Macho <i>A. tessellata</i>	Engle <i>A. tessellata</i>
GAB	80 1	96.3 ± 0.81 11, 92–99	77.5 ± 4.50 2, 73, 82	92.0 ± 0.88 24, 83–101	84.8 ± 1.00 20, 76–90	95.0 ± 0.61 16, 92–99	93.5 ± 0.98 40, 87–109	97.9 ± 0.44 29, 92–104
COS	19 1	21.5 ± 0.54 11, 18–24	12.5 ± 2.50 2, 10, 15	19.7 ± 0.68 26, 12–28	19.9 ± 0.62 20, 13–25	19.8 ± 0.84 17, 17–32	18.0 ± 0.24 40, 14–20	20.2 ± 0.35 29, 15–24
LSG	46 1	49.6 ± 1.18 11, 43–56	27.5 ± 1.50 2, 26, 29	43.0 ± 2.27 24, 26–65	40.3 ± 1.31 20, 33–53	43.1 ± 1.10 17, 34–53	34.8 ± 0.75 40, 23–45	34.9 ± 0.75 29, 30–48
FP	46 1	44.3 ± 0.66 11, 41–47	36.0 ± 2.00 2, 34, 38	45.8 ± 0.44 27, 41–50	44.8 ± 0.44 20, 41–48	44.3 ± 0.31 16, 43–46	41.4 ± 0.28 40, 37–46	44.4 ± 0.26 29, 41–47
GS	19 1	19.5 ± 0.46 11, 17–22	— —	21.9 ± 0.36 26, 17–26	20.2 ± 0.52 20, 17–26	17.8 ± 0.45 16, 14–21	19.5 ± 0.27 39, 16–23	21.7 ± 0.27 29, 19–25
PSC	19 1	20.0 ± 0.47 11, 18–22	— —	21.0 ± 0.38 26, 18–25	21.0 ± 0.25 20, 19–23	20.2 ± 0.30 17, 18–22	21.3 ± 0.24 40, 18–24	19.6 ± 0.22 29, 18–22
L-breaks ^b	— —	10.0 ± 1.58 11, 4–22	— —	— —	— —	7.4 ± 0.57 16, 4–13	11.5 ± 0.94 40, 2–26	23.8 ± 1.00 28, 11–32
DL-breaks	19 1	4.4 ± 1.75 11, 0–19	— —	— —	14.4 ± 1.83 20, 2–28	1.2 ± 0.44 16, 0–7	3.5 ± 0.81 40, 0–19	12.0 ± 0.82 28, 4–20
PV-breaks ^b	4 1	4.7 ± 1.24 11, 0–11	— —	— —	15.6 ± 1.37 20, 6–23	4.8 ± 0.46 16, 2–8	7.2 ± 0.78 40, 2–22	14.4 ± 0.77 28, 9–29
SDL-T4	38 1	38.7 ± 0.45 11, 36–42	31.5 ± 0.50 2, 31, 32	32.6 ± 0.28 27, 30–36	36.8 ± 0.32 20, 35–40	38.3 ± 0.31 17, 36–41	37.0 ± 0.23 39, 35–42	38.8 ± 0.23 29, 36–40
SVL	70 1	63.4 ± 3.19 11, 45–85	80.5 ± 2.50 2, 78, 83	78.0 ± 1.50 27, 57–90	88.9 ± 2.16 20, 56–97	77.5 ± 1.91 17, 66–91	88.5 ± 1.64 40, 59–109	86.9 ± 1.13 29, 75–99

^a Abbreviations for characters: GAB, number of granules (scales) around midbody; COS, number of circumorbital scales; LSG, number of lateral supraocular granules; FP, total number of femoral pores; GS, number of gular scales; PSC, number of scales contacting the outer perimeter of parietal and interparietal scales; L-breaks, total number of interruptions of the lateral stripes; DL-breaks, total number of interruptions of the dorsolateral stripes; PV-breaks, total number of interruptions of the paravertebral stripes; SDL-T4, number of subdigital lamellae on 4th toe of 1 foot; SVL, snout–vent length (mm).

^b Residuals from a regression of the character on SVL were used in the canonical variate analysis.

TABLE 2—Discriminant functions used to distinguish 4 populations of *Aspidoscelis tessellata* from Chihuahua, México, and the Rio Grande and Pecos River drainages, New Mexico. Characters described in Appendix 2.

Character	CV1	CV2	CV3
LSG	-0.871	-0.392	-0.631
GS	0.608	0.120	-0.628
DL-breaks	0.587	0.085	-0.149
L-breaks (residuals)	0.371	-0.244	-0.393
FP	0.269	-0.652	0.628
PSC	0.095	0.381	-0.146
COS	-0.202	-0.326	0.030
GAB	0.133	0.242	0.315
PV-breaks (residuals)	0.120	-0.162	0.394
Eigenvalue	5.425	1.786	0.261
Explained variation	72.6%	23.9%	3.5%

es taking place following hatching. Therefore, because different size classes were included in our samples (Table 1), there was a significant relationship between each of 2 color pattern characters, L-breaks and PV-breaks, and SVL ($R^2 = 0.10$; $P = 0.002$ and $R^2 = 0.06$; $P = 0.019$, respectively). We removed this ontogenetic variation by regressing each of the 2 characters on SVL and using the residuals for the character values. The third color pattern character, DL-breaks, did not express this relationship with SVL. We used SYSTAT 9 software (SYSTAT Software, Inc., Richmond, California) and canonical variate analyses (CVA) to achieve both goals of the study.

We used the 4 samples of *A. tessellata* (Benavides, Saucillo, Arroyo del Macho, and Engle) as a priori groups in a CVA to determine the pattern of morphological variation among the 4 populations. The CVA, based on 9 meristic characters (Table 2), provided an overall discrimination success of 96.5%, with the only misclassifications occurring in the Arroyo del Macho sample, where 3 of 39 individuals were classified as belonging to the Engle group. An ordination of canonical variate scores depicted the pattern of morphological variation (Fig. 1). The contradiction between a classification success of 100% for each of the Benavides and Saucillo samples and the extensive overlap of their CV scores (Fig. 1A) is explained by the distinctiveness of these groups in the third canonical variate (CV3), shown in Fig. 1B.

The pattern of variation shown in Fig. 1 seems to fit the geographic relationships among the 4 populations. The Chihuahuan

samples were morphologically similar, with the samples from New Mexico exhibiting greater divergence. This pattern was quantified by determining pair-wise Mahalanobis distances (D^2) between centroids of the CV scores, with smaller values indicating greater similarity. As was depicted graphically, the D^2 values reiterate the morphological divergence of the 2 northern populations from the morphologically similar Chihuahuan populations (Table 3). This divergence is assumed to reflect both phenotypic plasticity and clonal perpetuation of fixed random mutations.

An unusual abundance of *A. tessellata* \times *A. tigris marmorata* hybrids from Arroyo del Macho, Chaves County, New Mexico, provided an opportunity to characterize this kind of hybrid from morphological, histological, electrophoretic, karyotypic, and ecological perspectives (Taylor et al., 2001). The consistent feature marking the hybrid status of all 20 hybrids from Arroyo del Macho was a *tessellata*-like color pattern, minus the pale lateral stripe expressed in this population of *A. tessellata*. The missing lateral stripe suggested that males of *A. tigris marmorata* had participated in the hybridizations, and this was confirmed with electrophoretic and karyotypic evidence. The Benavides population of *A. tessellata* resembled the Arroyo del Macho population in having evidence of a lateral stripe. Similarly, the putative hybrid from Benavides resembled the hybrids from Arroyo del Macho in the absence of this stripe (Fig. 2). This coincidence implicated *A. tigris marmorata* in the hybridization, and a few individuals of this species were seen at the hy-

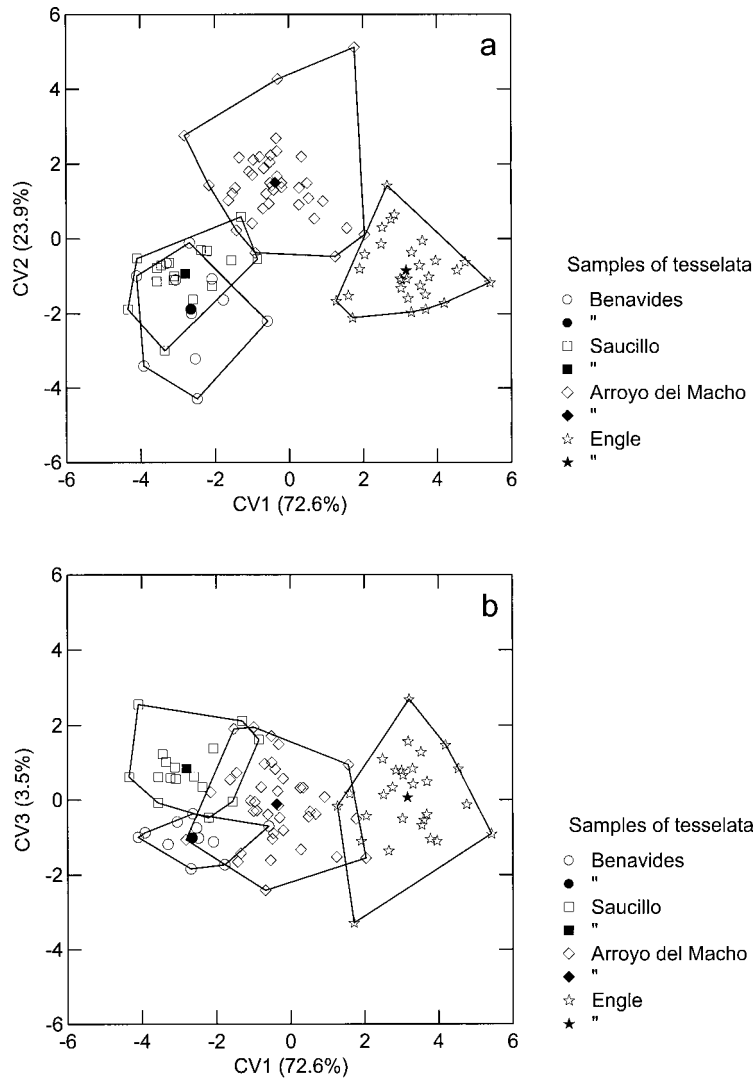


FIG. 1—Pattern of multivariate morphological variation among samples of *Aspidoscelis tessellata* from Benavides and Saucillo vicinities, Chihuahua, México, and representative samples of *A. tessellata* from Rio Grande (Engle) and Pecos River (Arroyo del Macho) drainages, southern New Mexico. A) ordination of scores for canonical variates 1 and 2, derived from CVA of 3 color-pattern characters and 6 scalation characters; B) ordination of scores for canonical variates 1 and 3 from same analysis. Solid symbols represent centroids of distributions.

bridization site. However, *A. gularis*, another potential sperm donor, was also syntopic with *A. tessellata* at this locality. Therefore, samples of *A. tessellata*, *A. tigris marmorata*, *A. gularis* (2 individuals from the hybridization site), and *A. tessellata* × *A. tigris marmorata* hybrids were used as a priori groups in a CVA, and the putative hybrid from Benavides was included in the model as unclassified for assignment to group.

Only 5 characters were used (Table 4) either because of interspecific differences in color patterns or because particular samples were not scored for certain characters (Table 1). The CVA classified the Benavides hybrid as belonging to the *A. tessellata* × *A. tigris marmorata* hybrid group ($P = 1.0$). This genealogy was supported by the unambiguous position of the hybrid in the ordination of canonical variate

TABLE 3—Pair-wise Mahalanobis distances (D^2) among centroids of canonical variate scores for samples of *Aspidoscelis tessellata* from the vicinities of Benavides and Saucillo, Chihuahua, México; Arroyo del Macho (=Macho; Pecos River drainage), Chaves County, New Mexico; and Engle (Rio Grande drainage), Sierra County, New Mexico. Canonical variate analysis model shown in Table 2.

	Benavides	Saucillo	Macho	Engle
Benavides	0.0			
Saucillo	4.4	0.0		
Arroyo del Macho	17.5	12.7	0.0	
Engle	36.1	36.1	18.1	0.0

TABLE 4—Discriminant functions used to verify identity of putative hybrid between *Aspidoscelis tessellata* and *A. tigris marmorata* from the vicinity of Benavides, Chihuahua, México. Characters described in Appendix 2.

Character	CV1	CV2
SDLT4	-1.005	0.143
LSG	-0.119	-0.083
GAB	0.454	0.953
COS	-0.096	0.231
FP	0.027	-0.053
Eigenvalue	3.593	1.759
Explained variation	59.7%	29.2%

scores (Fig. 3), the absence of a lateral stripe, and the presence of small postantibrachial scales. In contrast, an *A. tessellata* × *A. gularis* hybrid from the vicinity of El Pueblito, Chihuahua, México, has a lateral stripe and enlarged postantibrachial scales (Walker et al., 2000; Fig. 1).

The Benavides hybrid had testes measuring 2.4 by 1.6 mm (left) and 2.5 by 1.4 mm (right), but triploidy in such a hybrid would preclude fertility, even though sperm might be produced (Taylor et al., 2001). This is the first report of an *A. tessellata* × *A. tigris marmorata* hybrid from México; however, these hybrids are



FIG. 2—Comparison of lateral color patterns of left: representative of *Aspidoscelis tessellata* (UCM 60768, 71 mm SVL) and center and right: *A. tessellata* × *A. tigris marmorata* hybrid (UCM 60774, 70 mm SVL). Note presence of lateral stripe in *A. tessellata* (lower pale stripe on side) and its absence on hybrid. Absence of this stripe is characteristic of *A. tigris marmorata*.

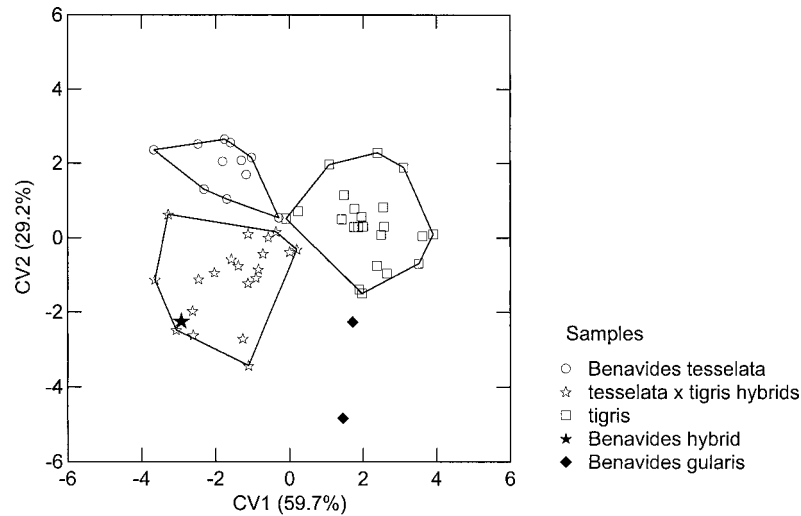


FIG. 3—Multivariate statistical verification of the genealogy of a putative *Aspidoscelis tessellata* × *A. tigris marmorata* hybrid collected with a sample of *A. tessellata* from the vicinity of Benavides, Chihuahua, México. Canonical variate analysis, using 5 meristic characters and 4 a priori groups composed of samples of *A. tessellata* and *A. gularis septemvittata* from Benavides, México, and samples of *A. tigris marmorata* and *A. tessellata* × *A. tigris marmorata* hybrids from Chaves County, New Mexico, assigned the putative hybrid to the hybrid group ($P = 1.0$).

expected at localities where *A. tessellata* and *A. tigris marmorata* are syntopic and the density of *A. tigris marmorata* is low relative to the density of the parthenogen (Taylor et al., 2001).

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APPENDIX 1

Specimens Examined and Locations—American Museum of Natural History (AMNH); Regis University (RU); Unidad de Biotecnología y Prototipos (UBIPRO); University of Colorado Museum (UCM).

Aspidoscelis tessellata—MÉXICO: CHIHUAHUA: Sierra Azul, near Manuel Benavides (29°6'52.5"N, 103°55'37.6"W) UBIPRO 4368, 4370; UCM 60768–60771; Puente Nuevo Lajitas-Paso de San Antonio, 6 km SE Manuel Benavides (29°5'27.7"N, 103°51'16.3"W) UBIPRO 4379, 4402; UCM 60772, 60773; Pueblo Manuel Benavides UBIPRO 4405; south side Rio San Pedro at Meoqui (approximately 28°15'N, 105°29'W) (UCM 37417); 21.2 km S Cd. Delicias (approximately 28°3'N, 105°20'W) (UCM 37418–37426); 1.61 km S Saucillo (approximately 28°1'N, 105°17'W) (UCM 37428, 37429); 4.0 km S Saucillo (approximately 27°59'N, 105°17'W) (UCM 37430–37434). These small samples were pooled to form Benavides and Saucillo samples respectively. USA: NEW MEXICO: SIERRA COUNTY: 13.2 km S Engle on road A13, then 1.1 km W (approximately 33°3'N, 107°3'W) (RU 9254–9259, 9271–9277, 9544–9559); CHAVES COUNTY: N side Arroyo del Macho (33°39'1"N, 104°33'17"W), 22 km N on US Highway 285 from junction with US Highway 70 N of Roswell, New Mexico, then 0.8 km E on Eden Valley Road (AMNH R-145142–145144, R-146612–146629, R-146631–146649).

Aspidoscelis gularis septemvittata—MÉXICO: CHIHUAHUA: Sierra Azul, near Manuel Benavides (29°6'52.5"N, 103°55'37.6"W) (UBIPRO 4205); Puente Nuevo Lajitas-Paso de San Antonio, 6 km SE Manuel Benavides (29°5'27.7"N, 103°51'16.3"W) (UBIPRO 4381).

A. tessellata × *A. tigris marmorata* hybrids—MÉXICO: CHIHUAHUA: Puente Nuevo Lajitas-Paso de San Antonio, 6 km SE Manuel Benavides

(29°5'27.7"N, 103°51'16.3"W) (UCM 60774). USA: NEW MEXICO: CHAVES COUNTY: N side Arroyo del Macho (33°39'1"N, 104°33'17"W), 22 km N on US Highway 285 from junction with US Highway 70 N of Roswell, New Mexico, then 0.8 km E on Eden Valley Road (AMNH R-145145–145149, R-146681–146695).

Aspidoscelis tigris marmorata—USA: NEW MEXICO: CHAVES COUNTY: N side Arroyo del Macho (33°39'1"N, 104°33'17"W), 22 km N on US Highway 285 from junction with US Highway 70 N of Roswell, New Mexico, then 0.8 km E on Eden Valley Road (AMNH R-146650–146653); 1.6 km W Pecos River, north side of US Highway 70, approximately 16.1 km E of interchange of US Highways 285 and 70 (approximately 33°34'N, 104°23'W) (AMNH R-146654–146680). These 2 samples (sampling localities 18 km apart) were pooled.

APPENDIX 2

Meristic Characters—GAB: the number of granular dorsal scales in a single row around the midbody. There are 8 longitudinal rows of enlarged scales cov-

ering the ventral body surface. The third ventral row on either side of the midsagittal line terminates anteriorly in the axillary region. The fifteenth ventral scale posterior to this terminus established the point for beginning the GAB count. COS: the bilateral total of circumorbital scales as standardized by Wright and Lowe (1967). LSG: the sum of lateral supraocular granules on both sides of the head. These granular scales are located between the supraoculars and superciliary scales, and the count includes all scales anterior to the suture line between the third and fourth supraoculars. FP: the sum of femoral pores on both thighs. GS: the number of granular gular scales bordering the medial edges of the 8 anterior sublabials [4 on each side, or their subdivisions] and the posterior mental. PSC: the sum of all scales, including occipitals, contacting the outer perimeter of parietal and interparietal scales.

The following 3 color pattern characters involve counts of the numbers of interruptions (breaks) in the primary pale stripes by transverse dark bars (of various widths). L-breaks: the total number of breaks in the 2 lateral stripes. DL-breaks: the total number of breaks in the 2 dorsolateral stripes. PV-breaks: the total number of breaks in the 2 paravertebral stripes.

NEW SUBSPECIES OF *SCELOPORUS MERRIAMII* (REPTILIA: LACERTILIA) AND THE DERIVATION OF ITS SUBSPECIES

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ABSTRACT—We describe a new subspecies of *Sceloporus merriami* from extreme southeastern Chihuahua and adjacent Coahuila. We discuss the derivation of the 7 subspecies now known of *S. merriami*.

RESUMEN—Se describe una nueva subespecie de *Sceloporus merriami* distribuida en el extremo sureste del estado de Chihuahua y partes adyacentes de Coahuila. Se discute la derivación de las 7 subespecies de *S. merriami* que hasta ahora se conocen.

The identity of the population of *Sceloporus merriami* in extreme southeastern Chihuahua and adjacent Coahuila has long been uncertain. Olson (1979) gave the first and only indication of the existence of the species there by dots on his map, assigned to *S. m. longipunctatus*. We have not been able to locate the specimens on which the dots were based. However, specimens collected by JAL-E in the same

area indicate that the population there represents 1 of the most distinct subspecies of *S. merriami*, as yet undescribed. It is here named.

Sceloporus merriami sanojae Lemos-Espinal,
subsp. nov.

Holotype—UBIPRO 7456, an adult male in excellent condition (Figs. 1, 2), from Rancho Peñoles, Chihuahua (27°7'49.6"N, 103°48'45.0"W),

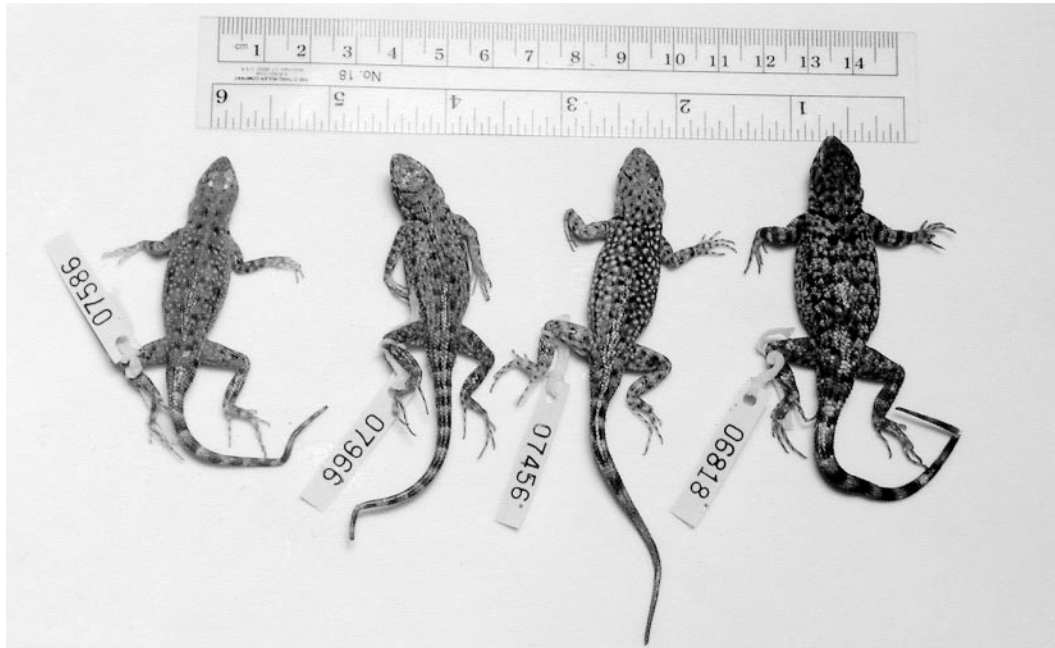


FIG. 1—Dorsal views, from right to left, of male *Sceloporus merriami annulatus* (UBIPRO 6818, Rancho El Virulento de Afuera, 28°45'50.5"N, 104°19'12.8"W); *S. m. sanojae* (male holotype, UBIPRO 7456); male *S. m. ballingeri* (UBIPRO 7966, Cementerio de La Campana, Durango, 26°7'39.1"N, 105°41'0.0"W); and male *S. m. williamsi* (UBIPRO 7586, Cañon del Pegüis, 29°30'24.1"N, 104°40'0.0"W).

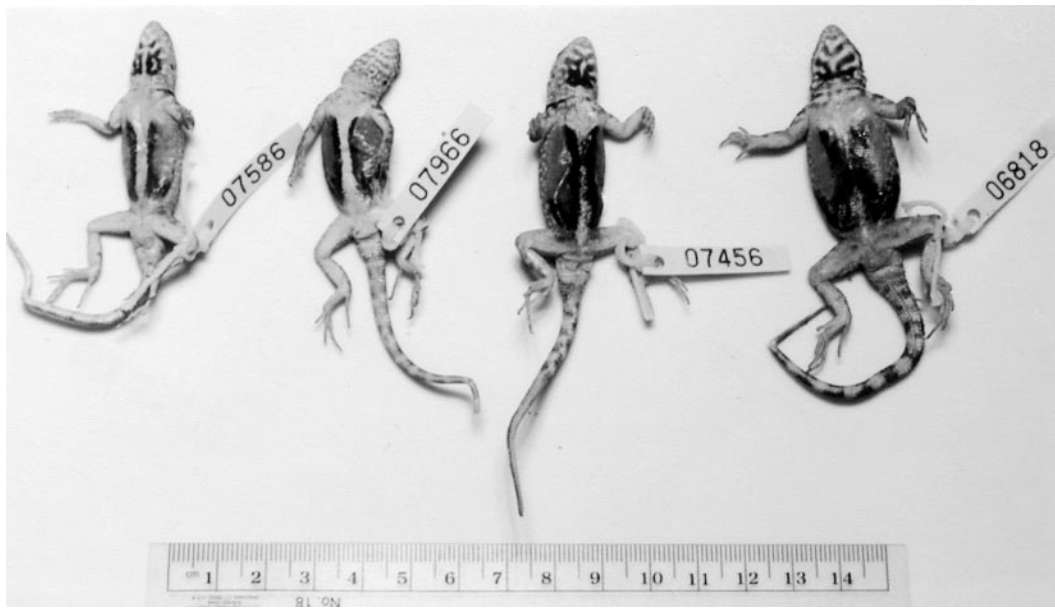


FIG. 2—Ventral views, from right to left, of male *Sceloporus merriami annulatus*, male *S. m. sanojae* (holotype), male *S. M. ballingeri*, and male *S. M. williamsi*. Musuem numbers and collection localities given in Fig. 1.

1,194 m elevation, 24 July 2001, Julio A. Lemos-Espinal.

Paratypes—Thirty-one, including 8 topotypes (UBIPRO 7437, 7441, 7454–5, 7457–60), 24–25 July 2001, same collector. The other paratypes are UBIPRO 7476–98, S end of Sierra Mojada, near Estación El Oro, Coahuila (27°14'25.5"N, 103°31'20.0"W), 1,141 m elevation, 27 July 2001, same collector.

Diagnosis—A subspecies of *Sceloporus merriami* categorically distinct in having profuse light dots dorsally and laterally in males (Fig. 1), laterally in females. Black smudges on the proximal ventral surfaces of the thighs in adult males are shared only with *S. m. annulatus*, in which they are much stronger and more extensive. Additional differences from the other subspecies follow. *S. m. australis* differs most conspicuously by its less numerous dorsals (42–53 versus 55–67). Three other subspecies differ in having usually fewer dorsals, but there is some overlap; *S. m. longipunctatus* has 93%, *S. m. ballingeri* 84%, and *S. m. annulatus* 93% less than 58, versus 9%. In addition, the latter subspecies has a conspicuously distinctive pattern (Fig. 1), with a dark background dorsally, and the paravertebral spots in the form of transverse bars extending to the sides of the body.

The other 2 subspecies, *S. m. williamsi* and *S. m. merriami*, have just as numerous dorsals as *S. m. sanojae* and differ from the latter solely in pattern. In *S. m. merriami* the gular semeions are poorly developed (Fig. 2), the dark parts restricted to the posterocentral part of the gular area, and the radiating extensions absent or pale; the caudal rings are also much less well defined; all contrast with the conditions in *S. m. williamsi* (Fig. 2). In the latter, the abdominal semeions are more widely separated than in *S. m. sanojae*.

Description of Holotype—Head scales smooth, those on snout with several apical pits, supraoculars single-pitted, few on median head scales from frontal posteriorly; 4 postrostrals; 1 row of 5 to 6 enlarged supraoculars, separated from superciliaries by 2 to 3 rows, from median head scales by 1 row; 2 pairs of enlarged internasals, bordered laterally by 3 small ones; 3 frontonasals, right one split horizontally, left one enlarged by fusion with anterior quarter of anterior half of frontal; 2–2 frontoparietals, in medial contact.

One postnasal; 2–2 canthals, anterior ex-

tended ventrad, separated from supralabials by 1 row of scales, contacting preocular on 1 side, separated by 1 scale on the other; 2 to 3 scale rows between posterior canthal and supralabials; 5 upper lorilabials in a row between postrostral and preocular; lower row of lorilabials complete between rostral and subocular; latter contacting a supralabial on 1 side, not on the other; 5–5 supralabials, 4–4 from subocular level to rostral; infralabials 6–6; labiomenal series contacting first infralabial on both sides.

Dorsals 62; 48 mm SVL; tail 63 mm, half regenerated.

Dorsal pattern dominated by numerous, scattered white dots (Fig. 1), separated by spaces 0.5 to 2 times the ca. 1-mm diameter of the spots, which extend laterally to the abdominal semeions; dark spots in paravertebral rows also roundish, equal to or slightly greater in diameter than the light spots; a lateral row, just above axilla-groin level, of similar dark and light spots; a black vertical slash on shoulder; interabdominal semeion space (Fig. 2) narrow, interrupted in 3 areas; laterally the semeions are purplish in preservative, with a broad, dark blue medial border extending into groin and proximal ventral surface of thigh. Gular semeions prominent, broadly fused posteriorly, with 4 bars radiating anteriorly and laterally, diminishing somewhat in intensity laterally. Dark caudal rings moderate in intensity dorsally, their interspaces of the same brownish color as the median ground color on trunk; ventrally the rings are incomplete, alternating with each other, and a little lighter than the dorsal components, although they are more prominent because of the white interspaces.

Variation—The 20 male paratypes vary from 29 to 49 mm SVL. The smallest has only faint abdominal semeions, although the gular semeions are clearly evident. In the next smallest, 35 mm SVL, both abdominal and gular semeions are well developed. All others are 42 to 49 mm SVL. The abdominal semeions are minimally separated by as many as 5 scales, in a 47-mm specimen and the 35-mm specimen; in others they are either in contact, at least narrowly, or minimally separated by no more than 2 scale widths. In all but 2 adults > 41 mm SVL, a dark smudge is evident on the proximal ventral surface of the thighs, and, in 1, the preanal area as well. The abdominal semeions are united with these smudges in some.

The gular semeions are dark laterally as well as medially, and usually fused posteriorly, a lighter blue anteriorly. The caudal dark rings are sharply defined and complete, both dorsally and ventrally, except where staggered. The dorsal light spots are present in all, even the smallest, although of various intensities. The posterolateral spots are usually the most prominent.

The 11 females vary from 24 to 47 mm SVL; all exceed 41 mm, except the smallest and one at 28 mm. All have moderately well developed gular semeions, less intense than in males, except in 1 at 47 mm. The dark borders of the abdominal semeions are faintly visible in 4 (42 to 47 mm), and not evident at all in the others. The dorsal light spots so characteristic of males are not or but faintly visible on dorsum, but on lower sides, axilla to groin, they are clearly visible in all specimens. They are especially prominent in a black streak anterior to the groin, much as in males.

In all 32 types, the dorsals vary from 55 to 67 (mean = 62); anterior section of frontal entire, except in 1 with 2 parts, another with 4; labiomentals irregular in one, reaching chinshield or first infralabial on 40 sides (63%), to neither in 24. The internasals are irregular; the lorilabial row is usually complete below the subocular; the first canthal contacts the preocular on 1 side in 3, but is enlarged in all (as in all members of the species), although horizontally divided on 1 side in 2; the frontoparietals are 2-2, except in 1 with 2-3, and 1 with 1-1; they are in contact medially, except in 5, and in 1, the contact edge on 1 side is irregular.

A complete, unregenerated tail is present in only 4; about half have a regenerated tail, often just the tip.

On the basis of pattern alone, *S. m. sanojae* could be regarded as a species, because its pattern is categorically distinct from that of all other subspecies, and its range is apparently dichopatric.

Etymology—The author of this nominal subspecies dedicates it to his wife, Susy Sanoja Sarabia, in honor of and gratitude for her long-term support in the field, in the laboratory, and at home.

Discussion—The intersubspecific variation in external morphology among the 7 subspecies of *S. merriami* now known (Smith, 1937; Williams et al., 1960; Smith et al., 1963; Olson,

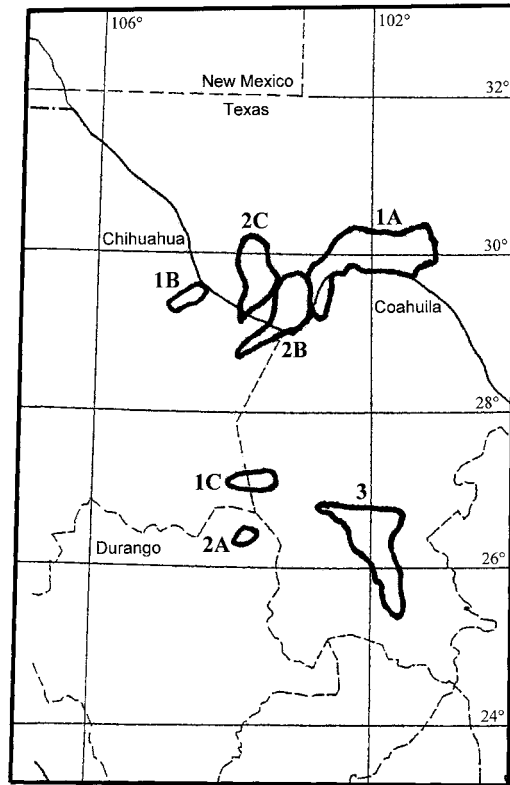


FIG. 3—Geographic ranges of the subspecies of *Sceloporus merriami* and their exerges. 1A) *S. m. merriami*; 1B) *S. m. williamsi*; 1C) *S. m. sanojae* (all of the *merriami* exerge). 2A) *S. m. ballingeri*; 2B) *S. m. annulatus*; 2C) *S. m. longipunctatus* (all of the *annulatus* exerge). 3) *S. m. australis* (of the *australis* exerge). Intergradation occurs at range contacts (Olson, 1971). Map based on Olson (1971) and other works in Literature Cited.

1971, 1973, 1979; Lemos-Espinal et al., 2000, 2001) is of considerable derivational interest. The subspecies *merriami*, *williamsi*, and *sanojae* (Fig. 3, numbers 1A-C) seem to constitute the *merriami* exerge (subspecies group; International Commission on Zoological Nomenclature, 1985:11), having a common ancestor different from that of the other subspecies despite being widely separated from each other. Their commonality is suggested by their small dorsal scales and high frequency of anterior extension of the labiomentals; neither occurs frequently in the other subspecies.

Then *ballingeri*, *longipunctatus*, and *annulatus* (Fig. 3, numbers 2A-C) seem to constitute another exerge (*annulatus*), sharing an interme-

Key to subspecies of *Sceloporus merriami*

1a. Dorsals 48 or fewer (65%)	<i>S. m. australis</i>
1b. Dorsals 49 or more (99–100%)	2
2a. Dorsal pattern dark, spots in paravertebral series transverse bars of more or less equal breadth throughout their length; abdominal semeions broadly in contact or narrowly separated (1 scale width) in adult males; tail rings prominent both dorsally and ventrally	<i>S. m. annulatus</i>
2b. Pattern different; other characters variable	3
3a. Dorsal pattern with numerous round light spots, in females restricted to the axilla-groin area	<i>S. m. sanojae</i>
3b. No so	4
4a. Dorsals 59 or more (100% excluding intergrades)	5
4b. Dorsals 58 or fewer (95% in <i>S. m. longipunctatus</i> , 84% in <i>S. m. ballingeri</i>)	6
5a. Paravertebral dark spots small, on only 3 to 4 scales; gular semeions posterocentral on throat, only dimly radiating anteriorly	<i>S. m. merriami</i>
5b. Paravertebral dark spots larger, rounded; gular semeions radiating dark anteriorly from posterocentral throat region	<i>S. m. williamsi</i>
6a. Paravertebral dark spots shaped like a transverse comma; tail rings not sharply defined	<i>S. m. longipunctatus</i>
6b. Paravertebral dark spots round or slightly rectangular; tail rings sharply defined	<i>S. m. ballingeri</i>

diate size of dorsal scales. Its members are also peripherally distributed, and 1 (*ballingeri*) is widely dichopatric from other members of that exerge.

A third exerge is composed of *australis* alone, which is widely dichopatric (Fig. 3, number 3) from other members of the species, and differs in having large dorsal scales.

There is thus a progression in scale size from exerges 1 through 3, each largely dichopatric or parapatric. The progression centers on the single subspecies *australis* and radiates northward and westward from that center. The configuration suggests that the derivation of these 3 groups was centrifugal, with the least advanced subspecies therefore being *australis* and the most advanced in exerge 1.

However, that would imply the likely independent evolution of the widely dichopatric 3 members of the first exerge, whereas the possession by all 3 of the labiomental character, as well as the small dorsals, suggests, although does not prove, otherwise. Therefore, consideration should be given to the possibility that *australis* is the most advanced subspecies—just the opposite of the preceding scenario. In that case, the *merriami* exerge would be the least advanced, and the *australis* exerge the most derived.

Although the second scenario seems unlike-

ly, the problem cannot be resolved by external morphology; a genetic study might provide the answer.

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VARIATION IN ZAPOTITLÁN CORALSNAKE, *MICRURUS PACHECOGILI* (SERPENTES: ELAPIDAE)

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ABSTRACT—*Micrurus pachecogili* is a rare coralsnake that inhabits the desert region around Zapotitlán Salinas in southern Puebla, Mexico. The original description of this species was based on 2 specimens. We report on morphological variation, sexual dimorphism, and distribution based on 4 additional specimens. Males have 218–223 ventrals, 43–48 subcaudals, and 24–30 black body rings; females have 235–242 ventrals, 37–39 subcaudals, and 29–30 black body rings. This new material was collected at localities within the Zapotitlán Basin. The coralsnake most similar to *M. pachecogili* seems to be *M. nebularis*, which is restricted to pine-oak forest near Ixtlán de Juárez in central Oaxaca. *Micrurus nebularis* is easily distinguished in having fewer ventrals (203–208 in males and 218–223 in females).

RESUMEN—*Micrurus pachecogili* es una especie rara de coral que habita la región desértica alrededor de Zapotitlán Salinas en el sur de Puebla, México. La descripción original de esta especie fue basada en 2 ejemplares. Reportamos la variación morfológica, el dimorfismo sexual, y la distribución de 4 ejemplares adicionales. Los machos tienen 218–223 ventrales, 43–48 subcaudales y 24–30 anillos negros en el cuerpo, mientras que las hembras poseen 235–242 ventrales, 37–39 subcaudales y 29–30 anillos negros. Este material nuevo fue colectado en varias localidades en la cuenca de Zapotitlán. La especie de coral más similar a *M. pachecogili* parece ser *M. nebularis*, la cual está restringida a los bosques de pino-encino cerca de Ixtlán de Juárez en Oaxaca central. *Micrurus nebularis* se distingue fácilmente por poseer menos ventrales (203–208 en machos y 218–223 en hembras).

Micrurus pachecogili (Zapotitlán coralsnake) inhabits the desert region of southern Puebla, Mexico. This species has remained elusive and was only recently described (Campbell, 2000) based on 2 specimens collected near Zapotitlán Salinas. Subsequent to its description, a few additional specimens have been found, all in the region of the type locality. An individual of this species was pictured and referred to *Micrurus fulvius* by Benítez-Gálvez (1997). In a footnote, this author stated this coralsnake was

found near Zapotitlán Salinas. One locally collected and badly preserved specimen of *M. pachecogili* was present at the botanic gardens “Helia Bravo Hollis,” located about 1 km E of Zapotitlán Salinas as late as 2002. Four specimens of *M. pachecogili* have become available in the Escuela de Biología, Benemérita Universidad Autónoma de Puebla (EB-UAP) collection. This material provides information on the morphological variation, sexual dimorphism, and distribution in this species. We ex-

amined a total of 6 specimens of *M. pachecogili* (EB-UAP 414, 477, 790–791; UTA R-12546–holotype, 17145–paratype); 3 of these are males and 3 are females.

Males have 218 to 223 ventrals and 43 to 48 subcaudals, and females have 235 to 242 ventrals and 37 to 39 subcaudals. There are uniformly 1 + 1 temporals, and supra-cloacal keels are lacking, even on large males. The number of black body rings varies from 24 to 30 in males and 29 to 30 in females, and the number of black tail rings (including black tail tip, when present) varies from 5 to 7 in males and 5 to 6 in females. Variation in the length of the body rings, measured as number of dorsal scales long, is as follows: black rings, 3 to 4; red rings, 2 to 4; and yellow rings, 1.5 to 2. Black rings tend to be the longest, followed by red and then yellow rings.

The snout is black without any pale spot in all specimens. The extent of the black pigmentation is remarkably similar among individuals in the sample, with black covering supralabials 1 through 3 and the upper anterior portion of supralabial 4. The 2 postoculars per side are mostly yellow, but black pigment is always present along the posterior edges of 1 or both of these scales. Two snakes lack black pigment on the upper postocular, and 3 lack black pigment on the lower postocular. The frontal is about 40 to 70% black, and the supraoculars are about two-thirds to four-fifths black in 4 specimens; 1 snake has entirely black supraoculars, and 1 snake has an entirely black supraocular and another that is edged (about posterior 10% of scale) with yellow. Black pigment is present on approximately the lateral or anterior half of the mental and first 2 pairs of infralabials and extends to the anterior portion of the anterior pair of chinshields in EB-UAP 414. EB-UAP 477 has a black spot on the posterior portion of the anterior chinshields.

The yellow parietal ring extends to just slightly behind the parietals in 2 specimens (UTA R-12546 and 17145), but in all others, black pigment from the nuchal ring barely encroaches on the posterior tips of the parietals. Dorsally the nuchal ring is 4 to 6.5 scales long. All snakes have a yellow ring above the vent, and the cloacal scale is yellow. The tip of the tail is black in 4 snakes (2 males, 2 females) and yellow in 2 (1 male, 1 female). The black

tail rings are 1.5 to 3 times longer than the yellow rings separating them.

The color in life is unusually bright in this species, relative to most other species of coralsnakes, and this bright coloration sometimes persists in preserved specimens. The yellow and red rings are usually unmarked with black, except for a few small dots in the red of 1 individual. A slight duskiness is present on the posterior portion of red scales and none covers the yellow pigment.

The largest male is the type (UTA R-12546), which has a total length (TL) of 63.9 cm, of which the tail comprises 13.6% of the total. The relative tail length in another adult male 61.0 cm in TL (EB-UAP 790) is 14.8%, and, in a juvenile (UTA R-17145), relative tail length is 11.0% of TL (32.7 cm). Two females are larger than the type, being 79.5 cm and 76.9 cm in TL, and have tails comprising 11.9% and 9.4% of the TL, respectively. A juvenile female 43.0 cm in TL has a tail that is 9.3% of the TL.

Micrurus pachecogili has not been found outside of the Zapotitlán Basin of southern Puebla, Mexico. The type and paratype came from 5.6 km SSW of Zapotitlán Salinas, 3 specimens came from about 1 km E of Zapotitlán Salinas, and 1 specimen was found on the gravel road to Los Reyes Metzontla about 3 km from Mexican Highway 125. Campbell (2000) briefly described this desert region, which receives less than 350 mm of rainfall per year. Specimens have been collected in August, November, and December.

The species of coralsnake most similar to *M. pachecogili* seems to be *M. nebularis*, which is restricted to the pine-oak forest near Ixtlán de Juárez in central Oaxaca. *Micrurus nebularis* is most easily distinguished in having fewer ventrals (203 to 208 in males and 218 to 223 in females). *Micrurus nebularis* has a more extensive black snout that covers all of the upper postocular and at least the anterior one-half of the lower postocular, most of the fourth supralabial, three-fourths or more of the frontal, all of the supraoculars and adjacent portion of the parietals, and usually there is more black on the chin.

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NEW BIRD RECORDS FROM TAMAULIPAS, MEXICO

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ABSTRACT—A list of 13 noteworthy bird species records from the state of Tamaulipas, México, is presented. Two records (*Agamia agami* and *Aquila chrysaetos*) are new for the state, and the remaining 11 extend significantly their distributional range.

RESUMEN—Se presenta un listado de registros notables de distribución para 13 especies de aves en Tamaulipas, México. Dos de los cuales (*Agamia agami* y *Aquila chrysaetos*) son nuevos para el estado y los restantes 11 extienden significativamente su área de distribución.

Most of the original landscape of central and northeastern Tamaulipas, a state located in northeastern Mexico bordering the Gulf of México, has been converted into cultivated areas. Consequently, finding new records of bird species native to the state is becoming less likely. However, a few sites preserve the original vegetation, and these fragments are important in maintaining the biodiversity of the region, which has been underestimated (Vargas-Contreras, 1998). The goal of this paper is to present new records of bird species for Tamaulipas, Mexico.

From August 1996 through May 1999, we surveyed 8 sites located in central, southern, and northeastern Tamaulipas, where scrub forest, grassland, mangrove, and deciduous forest were present. Sampling localities and vegetation types were as follows (Fig. 1): 1) La Playa Dos (23°1.105'N, 97°45.721'W), in tropical

semideciduous forest and coastal mangroves; 2) La Nacha (24°52.3'N, 97°48.8'W), in coastal scrub with aquatic vegetation; 3) El Nacimiento (23°59.2'N, 98°26.3'W), in riparian vegetation mixed with tropical semideciduous forest; 4) Cañón de la Carne (23°40.58'N, 99°15'W), in pine-oak forest located within the Altas Cumbres Natural Protected Area; 5) El Cañón del Novillo (23°43'N, 99°15'W), in tropical semideciduous forest also located within the Altas Cumbres Natural Protected Area; 6) El Sabinito (23°38.2'N, 98°24'W), in tropical semideciduous forest; 7) Vista Hermosa (23°48.5'N, 97°55.2'W), in tropical semideciduous forest; and 8) Enramadas (24°14.286'N, 97°49.329'W), in coastal scrub. Two methods were used to record bird species: observations (300 hours total) and mist-netting (525 net-hours). Selected voucher specimens were collected and are deposited in the vertebrate col-

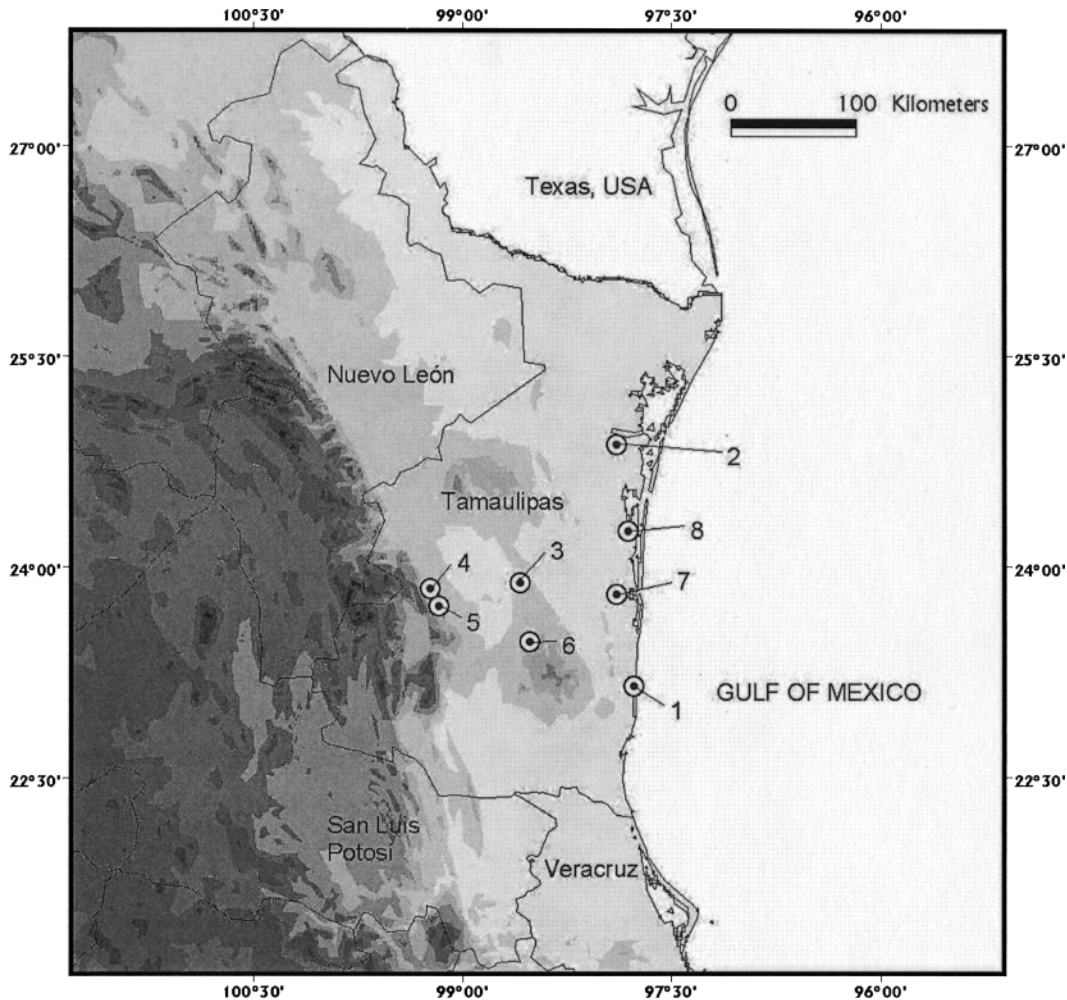


FIG. 1—Geographic location of sampling localities mentioned in the text: 1) La Playa Dos, 2) La Nacha, 3) El Nacimiento, 4) Cañón de la Carne, 5) El Cañón del Novillo, 6) El Sabinito, 7) Vista Hermosa, and 8) Enramadas. Underlying map is mean elevation from CONABIO (<http://www.conabio.gob.mx>).

lection of the Instituto de Ecología y Alimentos at the Universidad Autónoma de Tamaulipas (UATA).

We recorded 232 species in northeastern Tamaulipas, 5.6% of which had not previously been documented for the area. These new records represent important range extensions for these bird species in Mexico. A list of these noteworthy records is given below.

Scarlet Ibis, *Eudocimus ruber*—One individual was observed for several minutes flying a short distance on 16 August 1996 at La Nacha. The individual observed was clearly reddish overall, with a downcurved, slender beak. The domi-

nant vegetation was coastal scrub. This species was mentioned by Miller et al. (1957) as recorded in Matamoros, based on “hearsay” evidence, and thus was considered hypothetical by Howell and Webb (1995). The original distribution of the scarlet ibis was in South America, but it has appeared recently at scattered sites on the southeastern coast of the United States and in Central America (American Ornithologists’ Union, 1998). In April 1998, we returned to the area looking for this species, but it was not present. This species has been breeding in Florida for several years (Hancock et al., 1992), and our records from Tamaulipas

likely represent individuals blown far from normal distributional areas by storms or irregular seasonal movements.

Agami Heron, *Agamia agami*—Individuals of this species have been recorded previously as far north as southern Veracruz (Howell and Webb, 1995; American Ornithologists' Union, 1998) and Nuevo León (Contreras-Balderas, 1988). We observed 3 individuals in juvenile plumage (cinnamon striped underparts, and 1 of them had a few light blue feathers on the crown) at the mangroves at La Playa Dos from 9 through 25 January 1997, but not on a second visit (18 through 21 May 1998).

Common Black Hawk, *Buteogallus anthracinus*—A juvenile was observed on 16 August 1996 on the coastal side of the lake Las Nachas, perching in a mesquite tree. This species has not been recorded previously from the northeastern lowlands of Tamaulipas. The identification of this individual, as distinguished from similar hawks, especially the great black hawk (*B. urubitinga*), was warranted by the striped underparts with buffy linings, yellow lores, and malar stripes.

Golden Eagle, *Aquila chrysaetos*—An adult male was captured by local residents on 24 February 1999 at Cañón de la Carne (near El Cañón del Novillo), where the dominant vegetation was pine-oak forest. It was rescued and kept in captivity at the Tamatán Zoo in Ciudad Victoria and then donated to Fundación ARA in Monterrey, Nuevo León. The nearest previous record of this species was from eastern Nuevo León (American Ornithologists' Union, 1998). This record falls at the edge of the range plotted by Howell and Webb (1995).

Squirrel Cuckoo, *Piaya cayana*—This species was recorded at El Cañón del Novillo, (December 1995), El Sabinito (February and March 1997), Vista Hermosa (August 1996 to May 1997), and El Nacimiento (July 1997) along the Soto la Marina River. A voucher specimen was collected in Cañón del Novillo (UATA39, 3 December 1995). Although Howell and Webb (1995) indicated its northern range limit was in the southern section of the state, our records extend the known range northward to central and northeastern Tamaulipas.

Vermiculated Screech-owl, *Otus guatemalae*—Although this species has been recorded as far north as southern Tamaulipas (Howell and Webb, 1995; American Ornithologists' Union,

1998), we collected 2 adult male specimens at El Sabinito, 1 in gray phase (UATA81, 22 February 1997) and 1 in red phase (UATA117, 20 May 1997). Furthermore, we commonly detected vocalizations of this species at the same locality during April and July 1997. Our records expand the known geographic range northward to central Tamaulipas, at the edge of the range plotted by Howell and Webb (1995).

Ivory-billed Woodcreeper, *Xiphorhynchus flavigaster*—This species has been reported as far north as southern Tamaulipas (Howell and Webb, 1995; American Ornithologists' Union, 1998). However, several individuals were recorded at El Sabinito (1 female collected: UATA86, 25 March 1997), Vista Hermosa, and El Nacimiento, expanding the known range of the species northward to central Tamaulipas and along the coast.

White-throated Flycatcher, *Empidonax albigularis*—Although the known distribution of this species is in the Sierra Madre Oriental (Howell and Webb, 1995), we recorded it at several lowland localities. At El Sabinito, 27 individuals were mistnetted, at Vista Hermosa, 32 individuals, and at Enramadas, 7 individuals. Five individuals were collected, 3 at Vista Hermosa (UATA50, 9 August 1996; UATA53, 9 September 1996; UATA98, 24 April 1997) and 2 at Enramadas (UATA62 and UATA122, 4 June 1997).

Western Kingbird, *Tyrannus verticalis*—This species was collected at Enramadas in a dry scrub area near the coast on 29 April 1997. The specimen was an adult female (UATA106), which died tangled in the net due to extremely hot weather. No prior record exists for the species in the lowlands of Tamaulipas. However, 2 transients were observed in central and southern Veracruz (Howell and Webb, 1995). Thus, our record expands the distribution of western kingbird in Tamaulipas to the lowlands along the Gulf of Mexico, probably also as a rare transient.

Grey-collared Becard, *Pachyramphus major*—We observed this species on 2 occasions (26 February and 22 August 1997) at El Sabinito in the Sierra de Tamaulipas. Howell and Webb (1995) reported this species as a local resident in the southeastern corner of the state. Our records suggest that the species is also an uncommon resident in El Sabinito.

Golden-crowned Warbler, *Basileuterus culiciv-*

orus—This species was recorded at El Sabinito (Sierra de Tamaulipas), where 48 individuals were mistnetted from February to June 1997 (1 collected, 24 March 1997, UATA85), and at the coast in Vista Hermosa, where 1 individual was netted and released in September 1996. This warbler had not been recorded before from coastal Tamaulipas (Howell and Webb, 1995; American Ornithologists' Union, 1998).

Yellow-faced Grassquit, *Tiaris olivacea*—The species was recorded at 2 eastern localities: El Sabinito, where it is common in open areas and grasslands (groups of over 100 individuals were frequently observed), and Vista Hermosa (1 collected specimen, 31 May 1997, UATA119). Howell and Webb (1995) and American Ornithologists' Union (1998) mentioned that this species occurred only in western and southern sections of the state. Therefore, these records expand its distribution to the northeast to the coast of central Tamaulipas.

Melodious Blackbird, *Dives dives*—Five individuals were observed in Vista Hermosa on 8 May 1999 and 1 individual at El Sabinito (15 February 2002). The northernmost known range of this species was the southernmost part of Tamaulipas (Howell and Webb, 1995; American Ornithologists' Union, 1998). Our records expand its range northward to the central coast of Tamaulipas.

Recently, knowledge about the national avifauna has gained great importance due to interest in conservation of Mexican biodiversity. Some scientific publications are focused on the discovery of general distributional patterns of bird species richness and endemism (e.g., Escalante et al., 1993), but publications on local avifaunas and noteworthy records of specific bird species are a useful tool to fill gaps in knowledge on bird distributions.

The mountain and wetland areas in Tamaulipas are among the few relatively well preserved areas with high avian species richness in Mexico, but, unfortunately, they remain unknown or are poorly studied. For instance, we reported a total number of 232 bird species for northeastern Tamaulipas, which included noteworthy records of poorly known species (e.g., agami heron) and species of conservation concern (e.g., golden eagle). Our study enhances the importance of studies at both regional and local levels. It is necessary, however,

to continue with the inventory efforts in the state, especially because Tamaulipas is the northernmost limit of the range of many higher taxa from tropical regions (e.g., families Nyctiibidae, Cracidae, and Tinamidae; Escalante et al., 1993). These inventory efforts will not only contribute to our increased knowledge of bird distributional patterns in Tamaulipas, but also improve our understanding of the biogeography of North America avifauna.

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