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# A NEW SPECIES OF *XENOSAURUS* (SQUAMATA: XENOSAURIDAE) FROM THE SIERRA MADRE DEL SUR OF OAXACA, MEXICO

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ABSTRACT: We describe a new species of *Xenosaurus* from the Sierra Madre del Sur in Oaxaca and compare it to all the other species in the genus. The new species differs from the others by having 2–6 white spots on the infralabial-labiomental region on either side of the head, as well as the following combination of character states: second chinshields usually in medial contact with each other, few lamellae under the fourth toe (19–22, $\bar{x}$ = 19.4), and a short tail (tail length/snout–vent length ratio 0.73–0.79). The new species was collected in the crevices of small boulders in oak forest at about 2000 m elevation and is most similar to *X. rectocollaris* from southeastern Puebla.

*Key words:* Xenosauridae; *Xenosaurus*; New species; México; Oaxaca; Systematics

IN THEIR REVIEW of the lizard genus *Xenosaurus*, King and Thompson (1968) recognized only three species, one of them with five subspecies. The two monotypic species (*X. newmanorum* and *X. platyceps*) are confined to northeastern México (southeastern San Luis Potosí and southwestern Tamaulipas, respectively), whereas King and Thompson (1968) envisioned the remaining, polytypic species (*X. grandis*) as occurring from central Veracruz, México, south and east to Alta Verapaz, Guatemala.

Of the five subspecies of *Xenosaurus grandis* recognized by King and Thompson (1968), four are restricted to the states of Veracruz or Oaxaca in south-central México. *Xenosaurus g. grandis* occurs in west-central Veracruz, *X. g. sanmartinensis* is endemic to the Sierra de los Tuxtlas range in southern Veracruz, *X. g. agrenon* occurs at several localities in central and southern Oaxaca, and *X. g. arboreus* is known only from the mountains of the Sierra Madre in extreme southeastern Oaxaca, east of the Isthmus of Tehuantepec lowlands. The remaining subspecies, *X. g. rackhami*, occurs from west-central Chiapas in México east to Alta Verapaz in Guatemala. In addition to these taxa, King and Thompson (1968) regarded specimens from two localities in north-central Oaxaca (San Lucas Camotlán, in the Sierra Mixe, and Campamento Vista Hermosa, in the Sierra de Juárez) as intergrades of *X. g. grandis* and *X. g. rackhami*.

Smith and Iverson (1993) described *Xenosaurus rectocollaris* from near Chapulco in southeastern Puebla, México, raising the number of named taxa in the genus to eight. In addition, these authors mentioned the existence of an undescribed species from Cerro Acaltepec, San Juan Acaltepec, District of Yautepec, Oaxaca, but they did not formally describe it. Furthermore, these authors suggested that the population at Campamento Vista Hermosa, Oaxaca, might represent an additional undescribed species. More recently, Pérez-Ramos et al. (2000) described *X. penai* from isolated highlands of the Sierra Madre del Sur in Guerrero. The population of *X. penai* had been known for a number of years; however, it had been first referred to *X. g. agrenon* and then to the "*X. grandis* complex" by Pérez-Ramos and Saldaña de la Riva (1987, 1989).

Examination of 16 specimens of *Xenosaurus* from near San Juan Acaltepec, District of Yautepec, Oaxaca, collected in 1995 and 1999 by herpetologists at the Museo de Zoología "Alfonso L. Herrera" of the Facultad de Ciencias, Universidad Nacional Autónoma de México (MZFC), confirmed the distinctness of this population. Herein, we formally describe it and compare it with all known taxa in the genus. We follow the taxonomic arrangement of King and Thompson (1968).

## Methods

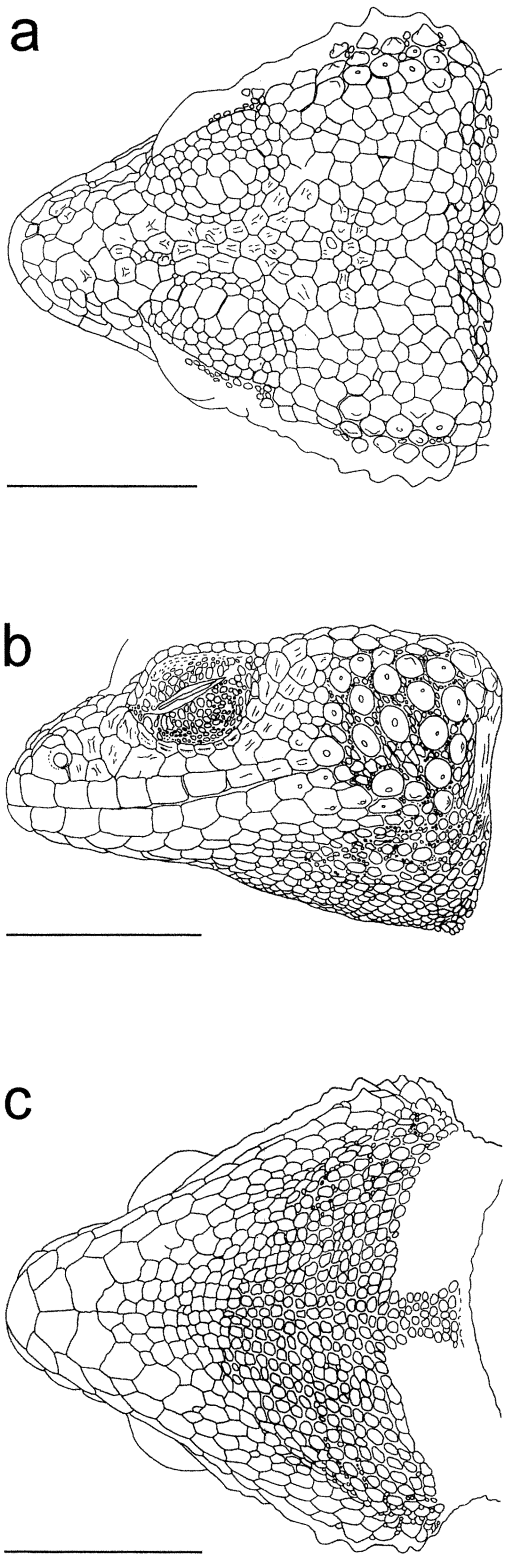
Field work near San Juan Acaltepec, municipality of Santa María Ecatepec, District of Yautepec, Sierra Madre del Sur, Oaxaca, was conducted in March 1995 and February 1999. Sixteen specimens of *Xenosaurus* were collected in this area. They were fixed in 10% buffered formalin, stored in 70% ethanol, and deposited at the MZFC. We compared individuals of the Acaltepec population with specimens of all the species and subspecies previously described in the genus, including the type series of *X. g. arboreus*, *X. g. agrenon*, and *X. penai*. Nomenclature of scales follows King and Thompson (1968) and Smith and Iverson (1993). Scale counts were performed with the aid of a dissecting microscope. Measurements were taken with calipers to the nearest 0.1 mm. Head length and snout length were measured from the tip of the snout to the anterior margin of the ear and from the tip of the snout to the anterior margin of the orbit, respectively. A list of specimens examined is provided in Appendix I. Acronyms for museums and collections follow Leviton et al. (1985), except for MZFC (see above), IBH-LT (Estación de Biología Tropical "Los Tuxtlas," Instituto de Biología, Universidad Nacional Autónoma de México, Veracruz, México), and CFSHER (Colección Herpetológica del Colegio de la Frontera Sur, San Cristóbal de las Casas, Chiapas, México). All measurements are given in millimeters. In the case of characters examined on both the left and right sides of each specimen, the corresponding conditions are reported in this order, separated by a slash. In the variation section, only character conditions different from those found in the holotype are reported. When two or three distinct, contiguous scales were present in most of the specimens and only one scale was found in others, we use the term "undivided" to describe the latter condition. However, this condition might have different origins (i.e., actual failure of the scales to divide or embryonic fusion). Description of climate at the type-locality follows Köppen's climatic system, modified by García (1964).

## Systematic Account

*Xenosaurus* ***phalaroanthereon*** sp. nov.

*Holotype.*—MZFC 12225 (field number LCM 975), an adult male (Figs. 1, 2) from approximately 6.1 km SW by road of San Juan Acaltepec (about 145.7 road km from turnoff on Mex. Highway 190 to San Juan Acaltepec), municipality of Santa María Ecatepec, Sierra Madre del Sur, Oaxaca, México (16° 14.93′ N, 95° 57.29′ W), 2005 m elevation.

*Paratypes.*—Fifteen specimens, all from Oaxaca, Sierra Madre del Sur, District of Yautepec, Municipality of Santa María Ecatepec; seven specimens from approximately 4 km NE San Juan Acaltepec (MZFC 7093–95, 7097–98; UTACV-R 46031–32) and eight (MZFC 12223–24,




12226, 12228–31; UTACV-R 46033) from the type-locality.

*Diagnosis (Table 1).*—*Xenosaurus phalaroanthereon* may be distinguished from all the other species in the genus by having 2–6 (usually three or four) white spots, sometimes faint, on the infralabial-labiomental region on either side of the head (white spots on the infralabial-labiomental region absent in the other species). In addition, it differs from all the other taxa in the genus, except *X. grandis agrenon,* in usually (in 94% of the specimens) having the second pair of chinshields in medial contact with each other anteriorly (second pair of chinshields separated by one or two gular scales in 94.7% of the intergrades of *X. g. grandis* with *X. g. rackhami,* $n = 19$; 93% of the specimens of *X. g. rackhami,* $n = 15$; and all of the examined specimens of the remaining taxa). Furthermore, *X. phalaroanthereon* differs from all the other species in the genus, except *X. rectocollaris,* in having fewer lamellae under the fourth toe (19–22, $\bar{x} = 19.4$, $n = 16$, in *X. phalaroanthereon*; 20–22, $\bar{x} = 20.5$, $n = 11$, in *X. rectocollaris*; $\geq 23$, $n \geq 5$, in each of the remaining taxa), and a shorter tail (tail length/snout-vent length ratio 0.73–0.79 in *X. phalaroanthereon*; 0.78–0.97 in *X. g. agrenon,* and 0.81–1.45 in the remaining taxa).

*Comparisons.*—In addition to the above characters, *Xenosaurus phalaroanthereon* differs from all of the subspecies of *X. grandis,* except *X. g. agrenon,* by having a dark nape collar which is restricted to the posterior half of the neck and which is separated from the dark postparietal marks and head by a pale, intervening transverse field. In *X. grandis,* exclusive of *X. g. agrenon,* the dark dorsal color of the head extends to the anterior half of the neck, narrowing posteriorly into a funnel-shaped mark which ends in a short, sometimes faint, middorsal line which is connected

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FIG. 1.—*Xenosaurus phalaroanthereon,* holotype, MZFC 12225. Head scales in (a) dorsal view, (b) left lateral view, and (c) ventral view. Horizontal lines = 1 cm.

FIG. 2.—*Xenosaurus phalaroanthereon* in life, MZFC 12225, holotype, from slides taken by L. Canseco-Márquez.

TABLE 1.—Variation in selected characters in the genus *Xenosaurus*.

| Characters/taxon | *grandis agrenon* $n = 14$ | *grandis arboreus* $n = 5$ | *grandis grandis* $n = 14$ | grandis integrades[1] $n = 19$ | *grandis rackhami*[2] $n = 15$ |
|---|---|---|---|---|---|
| White spots on infralabial-labiomental region | Absent | Absent | Absent | Absent | Absent |
| Second chinshields in medial contact | Usually (64%) | Never | Never | Rarely (5.3%) | Rarely (7%) |
| Subdigital lamellae on fourth toe | $\bar{x} = 25.5$ (23–28) | $\bar{x} = 24.4$ (23–26) | $\bar{x} = 27.5$ (24–29) | $\bar{x} = 28.5$ (26–31) | $\bar{x} = 28.2$ (25–31) |
| Tail length/snout–vent length[3] | 0.78–0.97 | 0.81–0.88 | 0.86–1.10 | 0.89–1.45 | 0.87–1.09 |
| Collar extended anteriorly | Variable | Yes | Yes | Yes | Yes |
| Ventum | With dark transverse bars | Uniform pale gray | With dark transverse bars | Usually with dark transverse bars, at least on sides (84.2%) | With dark transverse bars |
| Scales between medial postrostral and nasal[4] | 0–1 | 1 | Usually 1 (92.9%) | Usually 0–1 (89.5%) | 1 |

[1] *Xenosaurus grandis grandis* × *X. g. rackhami*.
[2] Sample size for subdigital lamellae on the fourth toe = 14.
[3] Data for all the taxa except *X. penai*, *X. phalaroanthereon*, and intergrades *Xenosaurus g. grandis* × *X. g. rackhami* taken from King and Thompson (1968) (sample sizes not specified).
[4] Two postrostrals are in contact along the midline (rather than a single, medial postrostral) usually in *X. g. agrenon*, and rarely in *X. newmanorum*, *X. platyceps*, and intergrades *Xenosaurus g. grandis* × *X. g. rackhami*.

posteriorly with the nuchal collar. The sides of the funnel-shaped mark are separated from the collar by the pale, oblique stripes representing the posterior extensions of the subocular stripes (sensu King and Thompson, 1968).

Furthermore, *Xenosaurus phalaroanthereon* differs from all of the subspecies of *X. grandis*, except *X. g. arboreus*, by having a venter that is usually immaculate (venter with only a few, small, scattered dark marks on the sides of the abdomen in 31% of the specimens). In *X. grandis*, exclusive of *X. g. arboreus*, the venter usually exhibits dark transverse bars, sometimes faint, at least on the sides of the abdomen [in 84.2% of the intergrades of *X. g. grandis* with *X. g. rackhami* ($n = 19$), 93.8% of the specimens of *X. g. sanmartinensis* ($n = 16$), and all of the specimens examined of *X. g. agrenon* ($n = 14$), *X. g. grandis* ($n = 14$), and *X. g. rackhami* ($n = 15$), although the venter is immaculate in some specimens of *X. g. agrenon* (fide King and Thompson, 1968)].

*Xenosaurus phalaroanthereon* may be distinguished additionally from the geographically closest representative of the genus, *X. grandis agrenon*, in having (Fig. 1a) a moderately large, medial postrostral flanked by a much smaller postrostral on either side (lateral postrostral absent or medial and lateral postrostrals undivided on one or both sides in 69% of the specimens, but postrostrals essentially never paired) and (Fig. 1b) the postocular and zygomatic ridges in contact throughout most or all of their parallel lengths (a small, single scale between the ridges on one side in 37.5% of the specimens). In *X. g. agrenon*, there are usually (in 78.6% of the specimens; $n = 14$) two moderately large postrostrals in contact with each other along the midline (in addition to a much smaller, lateral postrostral on either side, absent on one or both sides in some specimens), and the postocular and zygomatic ridges are separated by a row of small to moderately large scales throughout most of their parallel lengths.

*Xenosaurus phalaroanthereon* may be distinguished from both *X. newmanorum* and *X. platyceps* in having (Fig. 1a) only one small, lateral postrostral scale between the enlarged, medial postrostral and the nasal scale (lateral postrostral absent or

TABLE 1.—Extended.

| *grandis sammartinensis* $n = 16$ | *newmanorum* $n = 11$ | *penai* $n = 7$ | *phalaro-anthereon* $n = 16$ | *platyceps* $n = 13$ | *rectocollaris* $n = 11$ |
|---|---|---|---|---|---|
| Absent | Absent | Absent | Present | Absent | Absent |
| Never | Never | Never | Usually (94%) | Never | Never |
| $\bar{x} = 28.4$ (27–30) 0.88–1.03 | $\bar{x} = 30.3$ (29–32) 0.93–1.03 | $\bar{x} = 25.0$ (24–27) 0.84–1.04 | $\bar{x} = 19.4$ (19–22) 0.73–0.79 | $\bar{x} = 26.0$ (23–28) 0.92–1.13 | $\bar{x} = 20.5$ (20–22) 0.89–1.06 |
| Yes | Variable | Yes | No | Variable | No |
| Usually with dark transverse bars (93.8%) | Usually immaculate or with few, small dark spots on sides (81.8%) | With dark transverse bars | Immaculate (69%) or with few, small dark spots on sides | Usually immaculate or with few, small dark spots on sides (92.3%) | Immaculate |
| Usually 0–1 (96.9%) | 2–3 | 0–1 | 0–1 | 2–3 | Usually 0–1 (90.9%) |

medial and lateral postrostrals undivided on one or both sides in 69% of the specimens) and largest supraoculars hexagonal, distinctly wider than long. In *X. newmanorum* and *X. platyceps,* there are 2–3 small lateral postrostrals between the medial postrostral and the nasal scale, and the largest supraoculars are rounded, only slightly wider than long.

Similarly, *Xenosaurus phalaroanthereon* may be further distinguished from *X. rectocollaris* by having an enlarged, medial postrostral that is about as long as wide or longer than wide, and a middorsal white spot on the anteriormost dark caudal band. In *X. rectocollaris,* the medial postrostral is wider than long, and the anteriormost dark caudal band has paravertebral, dorsolateral or lateral, but not middorsal, pale marks. *Xenosaurus phalaroanthereon* may be further distinguished from *X. penai* by having an immaculate or nearly immaculate venter (see above) and (Fig. 2) a pale transverse field between the dark nape collar (restricted to the posterior half of the neck) and the dark postparietal marks (versus dark transverse bars on sides of the abdomen and a dark nape collar that is connected to the postparietal marks by either a narrow, dark middorsal line or paravertebral lines).

*Description of the holotype (Figs. 1, 2).*—An adult male, 102 mm in snout-vent length (SVL), with a moderately stocky body and long limbs (shank length 0.15 times SVL), and a comparatively short tail (length 0.75 times SVL).

Head broadly triangular in dorsal view (length 0.24 times SVL; maximum width 0.94 times length), thick (maximum height 0.53 times length). Snout length 0.33 times head length, bluntly pointed.

Dorsal head scales smooth, juxtaposed. Enlarged supraoculars and parietal scales flat; remaining dorsal scales slightly to moderately convex; those of supraorbital semicircles and row between them slightly keeled. Rostral damaged (most epidermis peeled off), slightly more than twice as wide as long, slightly narrower than mental; posteromedial process absent. One moderately large, medial postrostral and two distinctly smaller, lateral postrostrals between nasal scales. Medial postrostral squarish, about as wide as long; posterior margin straight, roughly perpendicular to midline. Lateral postrostral on left side slightly narrower and shorter than, nearly half as large as, medial postrostral; approximately triangular; posterior end bluntly pointed. Lateral postrostral on right side roughly square; much narrower and short-

er than, only about one-fourth as large as, medial postrostral. One enlarged, obliquely-oriented scale (hereinafter called enlarged internasal) on either side between supra- and postnasal scales and midline, separated from enlarged internasal on opposite side by one middorsal scale row; anterior end level with anterior margin of nostril. Four undifferentiated scales, subequal in size, posterior to enlarged internasals, extending transversely across snout (three and two scales in contact with enlarged internasal on left and right sides, respectively). Scales between anterior ends of supraorbital semicircles subequal in size, without a discernable pattern. Supraorbital semicircles separated along midline by one scale row. Supraocular scales in six roughly longitudinal rows at level of midsupraocular region [one main row composed of 4/5 largest supraoculars, moderately wider than long (length about two-thirds width); two supraoculo-orbital rows; three rows between largest supraoculars row and superciliaries]. Scales in row immediately lateral to largest supraoculars row moderately enlarged; scales in remaining rows small, granular. Scale row adjacent to superciliaries and supraoculo-orbital rows long, more-or-less continuous; remaining rows short, represented by few scales. Superciliaries 11/11. Parietals uniform in size, not arranged in any definite pattern.

Nasal scale moderately large, slightly longer than high, completely encircling nostril; nostril located on posterodorsal corner. Nasal bordered dorsally at level of nostril by one small, slightly longer than wide, supranasal; and posteriorly by one small, moderately tall, slender upper postnasal and one small, roughly rectangular (slightly higher than long) lower postnasal (almost completely fused with anteriormost loreal scale on right side). Preoculars moderately large, irregularly elevated; becoming gradually smaller, keeled, posteroventrally. Suboculars small, bluntly keeled longitudinally; gradually turning at level of posterior margin of orbit into progressively larger, higher, moderately keeled postocular scales behind orbit, forming postocular ridge extending dorsally to parietal–temporal contact region. Loreals 4/3 (small, anteriormost one almost completely fused to lower postnasal on right side), large, irregularly convex; scales reaching canthus rostralis 1/1; minimum scale count between canthus rostralis and supralabial row 2/2; scales in contact with postnasals 2/3; in contact with supralabial row 3/1. Lorilabial scales slightly smaller than loreals; markedly larger than suboculars; irregularly convex. Lorilabial row bifurcating at level of posterior margin of orbit into a scale or short scale row (left and right sides, respectively) adjacent to supralabial row and a longer row of slightly larger, higher, keeled scales extending dorsally to parietal-temporal contact region, forming zygomatic ridge. Postocular and zygomatic ridges in contact throughout all of their parallel lengths (slightly divergent dorsally); no scales between ridges. Canthus rostralis indistinct, rounded; bordered laterally by uppermost preocular, loreal scales, and upper postnasal. Parietal–temporal contact region rounded, lacking a canthus temporalis demarcated by enlarged or well-differentiated scales; parietal and temporal scales grading into each other; adjacent to each other on anterior half of transition region; narrowly separated by one row of small granules posteriorly. Temporal scales posterior to zygomatic ridge small, juxtaposed, gradually grading (posterior to level of mouth) into conical, increasingly large, moderately pointed tubercles; largest tubercles separated from each other by one or two rows of granules (distance between tubercles usually $\leq$ one-fourth their own diameter). Temporal tubercles extending posteriorly to anterior margin of tympanum; ventrally to level of labiomental row. Tympanum moderately large (height 0.23 times head length), vertically oval, covered with a thick membrane with small, granular scales. Supralabials 10/10; those along snout moderately high, gradually decreasing in height posteriorly below orbit to penultimate scale; posteriormost scale distinctly higher than penultimate one. Anteriormost two supralabials slightly convex, smooth; remaining scales in row increasingly convex and keeled posteriorly; grad-

ually conical at posterior end of row. Infralabials 10/9; anterior to about mid-orbit moderately high (second highest), gradually decreasing in height posteriorly. Anteriormost two infralabials slightly convex, smooth; remaining scales in row increasingly convex and keeled posteriorly; gradually conical at posterior end of row.

Row of five enlarged chinshields posterior to mental on either side; second scale largest in row (slightly larger than first); chinshields posterior to second gradually decreasing in size posteriorly. Chinshield and infralabial rows separated posteriorly by continuous labiomental scale row beginning at level of mid-second scale in each row. Anterior labiomentals small, flat; remaining scales in row becoming gradually larger, increasingly convex and keeled posteriorly; conical at posterior end of row. First and second chinshields in medial contact (second in contact anteriorly, nearly as long as one-half length of chinshields); separated from each other posteriorly by two gular scales. Throat and gular region covered by small, granular scales, arranged in slightly oblique, longitudinal rows. Gular fold well developed. Additional weaker transverse fold at level midway between tympanum and anterior insertion of arms.

Dorsal tubercles at midbody flat; not arranged in definite pattern; those on middorsum and area between paravertebral and dorsolateral regions small (only moderately larger than granular scales between them), usually widely separated from each other by two or three (1–4) granular scale rows (distance of about one-half to twice their own diameter); those on paravertebral region less numerous and larger than those on rest of dorsum, narrowly separated from each other by one (occasionally two) granular scale rows (distance approximately equal to one-half to three-fourths their own diameter); paravertebral rows absent. Tubercles on dorsolateral and lateral regions conical, low, bluntly pointed, distinctly larger than those on middorsum, arranged in transverse rows; tubercles in rows separated from each other and from those in adjacent rows by about 4–5 granular scale rows (distance approximately equal to their own diameter); tubercles usually decreasing in size medially, grading with paravertebral tubercles (uniform in size, abruptly differentiated from latter tubercles in some cases). Weak lateral fold extending from axilla to groin. Scales on pectoral region moderately large, flat, four- to six-sided, arranged in oblique rows, gradually becoming rectangular, arranged in transverse rows, posteriorly. Ventral scales rectangular, longer than wide, each with central, small, circular depression. Ventral scales along midline between levels of axilla and groin approximately 35; scales in a transverse row at level of midbody about 23. About four transverse rows of enlarged, smooth, rhomboid preanal scales (medial scales in each row larger than lateral ones), separated from ventrals at level of groin by 3–4 transverse rows of smaller, shorter scales.

Tubercles on dorsal surface of arms moderately large, conical, pointed, narrowly separated from each other by single granular scale row (distance of about one-fourth to one-half their own diameter). Scales on anterior surface of thigh flat, juxtaposed, four- to six-sided, gradually becoming conical, low, blunt tubercles posteriorly on dorsal surface of thigh; tubercles less numerous than those on arms; separated from each other by about 2–3 granular scale rows (distance from slightly more than one-half to slightly more than tubercle diameter). Subdigital lamellae on fourth toe 21/21. Tail circular in cross section, moderately widened at base. Caudal scales arranged in transverse rows; rectangular (slightly longer than wide), flat, juxtaposed on posterior two-thirds and ventral half of anterior third of tail; gradually becoming circular, slightly convex, separated by single granule rows anteriorly on dorsal half of anterior third, merging with dorsal and dorsolateral tubercles on posterior end of body. Transverse scale rows moderate in width ventrally; rows gradually decreasing in width laterally and dorsally alternating with rows splitting dorsally into two from about middle height (width of two adjacent rows on ventral surface $\cong$ width of three adjacent rows on dorsal surface).

*Color in life (Fig. 2).* Dorsal and lateral surfaces of head brown; black flecks present on most enlarged supraoculars, posterior portion of supraorbital semicircles, parietal region (at posterolateral corner and midway between midline and lateral margin of parietal region), anterior half of parietal-temporal contact region, center of temporal region, and supralabial scales posterior to level of mid-orbit. Gular region grayish white; three faint, white spots on infralabial-labiomental region (on first–second, third, and fifth–sixth infralabials) on either side.

Dorsal ground color of body brown. Two small, black, approximately circular postparietal marks, one on either side of body. Narrow black collar composed of black tubercles and reticulations on posterior half of neck; separated from postparietal marks by brown transverse stripe. Anterior margin of collar positioned at about mid-neck, moderately concave anteriorly on either side of midline; posterior margin at level of anterior arm insertion, moderately concave anteriorly. Collar extending laterally to slightly below level of dorsal ear margin; anterolateral corner widely separated from ear. Four black transverse bands on dorsum between levels of axilla and posterior margin of insertions of legs, continuous across midline, extending laterally to nearly sides of abdomen; more or less solid on middorsum (especially along anterior and posterior borders), becoming gradually fragmented laterally (represented mostly by black scattered tubercles and reticulations on flanks); separated from each other and nape collar by brown transverse interspaces. Collar and anteriormost two black transverse bands with brown middorsal streak; posteriormost crossband with faint, brown middorsal spot. Ventum grayish white; immaculate.

Dorsal surface of forelimb brown, unicolor except for few black speckles on arm. Dorsal surface of hindlimb brown with black, irregular blotches and some white tubercles; black irregular bars and streaks present on anterior and posterior surfaces of thigh and shank. Ventral surface of limbs grayish white; black streaks present on shanks. Toes with alternating black and pale brown rings; black rings faint ventrally. Ten black rings present on tail (posteriormost at tip), separated from each other by pale, slightly narrower rings; pale rings brown dorsally (slightly, but distinctly, paler than body ground color); cream ventrally. First black ring with a faint, brown middorsal spot and irregular, cream midventral marking extending laterally and dorsally to about middle height. Black rings solid dorsally; second to penultimate with irregular, cream midventral marking; marking extending somewhat laterally on second to fifth anteriormost rings.

*Measurements:* Head width 23.3; head length 24.9; head depth 13.2; snout length 8.2; ear height 5.7; shank length 15.3; tail length 76.5.

*Variation.*—We describe below character conditions found in the remaining specimens examined, different from those observed in the holotype.

Pattern of dorsal head scales similar to that of holotype in all paratypes, except scales becoming increasingly convex during ontogeny. Rostral partially divided into three parts of approximately equal width by two narrow, shallow grooves curving ventrolaterally from dorsal margin to about one-half to two-thirds rostral height in all intact specimens (rostral scale damaged on one side in two specimens; on both sides in one). Left and medial postrostrals undivided in four specimens (right postrostral slightly narrower and longer than medial postrostral in one); right and medial postrostrals undivided (left postrostral narrower, slightly longer than medial postrostral) in one. Single postrostral in six specimens; enlarged, symmetrical (medial and lateral postrostrals undivided) in two; enlarged, asymmetrical (medial and only one lateral postrostral undivided) in three; reduced (lateral postrostrals presumably absent) in one.

Enlarged internasals in medial contact with each other in seven specimens, irregularly shaped in one. Anterior margins of enlarged internasals at level of mid-nostril in one specimen; at about level of midnasal in three. Enlarged internasals followed posteriorly by three scales (en-

larged, medial scale bordered laterally by smaller scales) in 11 specimens; followed by two enlarged, transversely elongated scales in medial contact in one. Supraorbital semicircles in narrow contact in three specimens; in wider contact (involving one and two scales of left and right semicircle, respectively, but shorter than one-scale length) in one. Four enlarged supraoculars on either side in eight specimens; 4/5 or 5/4 in seven (including holotype) and 3/4 in remaining specimen. One complete and one incomplete supraoculo-orbital scale row on either side in three specimens; on one side in two; single supraoculo-orbital scale row on both sides in one. One medium-sized and one granular scale row between largest supraoculars and superciliaries on both sides in three specimens; on one side in one. Supraoculo-orbitals adjacent to largest supraocular row composed of moderately enlarged scales in three specimens. Superciliaries 9–12, $\bar{x}$ = 11.0 (30 counts).

Upper, elongated postnasal divided transversely on one side in three specimens. Lower postnasal divided into two scales (a very small one ventral to nasal and a larger one posterior to nasal) on left side in three specimens. Lower postnasal and anteriormost loreal undivided on both sides in five specimens; on one side in two. Loreals in 13 specimens three (anteriormost loreal and lower postnasal undivided) or four (3/3 in four, 3/4 and 4/3 in one each, 4/4 in seven; minimum loreal count between canthus rostralis and supralabial row, number of loreals in contact with postnasals, and number of loreals in contact with supralabial row for loreal counts of three and four 3 and 2–3, 3 and 2–3, and 1 and 2, respectively); loreals in remaining two specimens 2/3 (anteriormost loreal and lower postnasal undivided on either side; two loreals undivided on left side) and 3/5 (postnasals normal); minimum count of loreals between canthus rostralis and supralabial row and number of loreals in contact with postnasals 2/3 in both specimens; number of loreals in contact with supralabial row 1/1 and 2/2, respectively. Small or medium-sized scale between postocular and zygomatic ridges on one side in six specimens. Most or all large temporal tubercles blunt or bluntly pointed in eight specimens (three adults, two subadults, and three juveniles); pointed in seven (four adults and three subadults). Supralabials 9–11, $\bar{x}$ = 9.9 (29 counts); infralabials 8–11, $\bar{x}$ = 8.9 (30 counts).

Enlarged chinshields 3–6, $\bar{x}$ = 4.5 (30 counts). Labiomental row beginning from first to third chinshield and first to third infralabial. First chinshield about as large as, or larger than, second one on either side in one specimen; on one side in six. Medial contact of anterior portion of second chinshields reduced to a point (chinshield on right side shifted posteriorly) and second chinshields separated by gular scales in one specimen each.

Dorsal, dorsolateral, and lateral body scales similar to those of holotype in all paratypes, except separation between enlarged tubercles narrower in two specimens. Transverse ventral scale rows between levels of axilla and groin 33–37, $\bar{x}$ = 35.3 ($n$ = 15). Ventral scales in a transverse row at level of midbody 21–24, $\bar{x}$ = 23.1 ($n$ = 14). Limb tubercles about as pointed as in holotype in all adult and two subadult specimens; bluntly pointed in two subadults; flattened, blunt, in all juveniles.

*Color (in preservative):* Three diffuse, black spots on infralabial-labiomental region on either side in one specimen. White spots on infralabial-labiomental region on either side 2–6, $\bar{x}$ = 3.5 (30 counts).

A narrow, black middorsal line extending between nape collar and first black crossband and between posteriormost two black crossbands in one specimen; between posteriormost two crossbands in one; between posteriormost crossband and first tail ring in two; between posteriormost two crossbands and between posteriormost crossband and first tail ring in two; between second and third crossbands, third and fourth crossbands, and posteriormost crossband and first caudal ring in one; between second and third crossbands in one; between third and fourth crossbands in one. Pale middorsal spots on nape collar and black crossbands varying from faint, diffuse, indistinct or absent, to

well-defined. Five black crossbands between levels of axilla and posterior insertion of legs in two specimens. First and last black crossbands narrow and a single, wide crossband between them (partly divided transversely into two on left side, into three on right side) in one specimen. Few (4–8), scattered, black speckles or scales on lateral margins of abdomen in five specimens (black speckles on preanal area in one).

Black caudal rings 9–12, $\bar{x}$ = 10.4 ($n$ = 13). Irregular, cream midventral markings on all black caudal rings except last one in seven specimens with unbroken tails; in all except last two rings in two; in all except last three rings in two; and in all except last four and five rings in one specimen each; markings on second to last rings restricted to ventral surface or barely extending on sides of tail, especially those of second to fifth rings. First and second black rings with two paravertebral brown streaks on anterior half and single brown middorsal spot, respectively, in one specimen. Posteriormost four or five pale caudal rings white (remaining pale rings ground-colored) in one juvenile each (tail broken in remaining juvenile). Pale caudal rings generally paler in younger specimens.

*Measurements:* Measurements and proportions of adult and subadult specimens, including the holotype ($n$ = 12, SVL 79.4–113.2), are provided in Table 2.

*Distribution and ecology.—Xenosaurus phalaroanthereon* is known only from the type-locality (about 6.1 km SW San Juan Acaltepec, Fig. 3) and another, relatively close, locality about 4 km NE San Juan Acaltepec. Most of the specimens were collected in the crevices of relatively small boulders (height about 1 m) scattered on rocky slopes covered with low oak trees (height about 3 m; Fig. 4). Undergrowth was mostly herbaceous and sparse; most lizards were collected in crevices of boulders in close proximity of each other. The lower areas in the region (e.g., on road from San Juan Acaltepec to the type-locality) are covered with oak-pine forest, whereas at higher elevations (e.g., slopes at the type locality) the oak-pine forest is

TABLE 2.—Variation in selected morphometric characters[1] and proportions in the type series[2] of *Xenosaurus phalaroanthereon*.

| Specimen/character | SVL | HW | HL | HH | SNL | SHL | TL | HW/HL | HL/SVL | HH/HL | SNL/HL | SHL/SVL | TL/SVL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| MZFC 12229 | 79.4 | 22.7 | 26.2 | 13.4 | 8.9 | 14.3 | — | 0.87 | 0.33 | 0.51 | 0.34 | 0.18 | — |
| UTACV R-46033 | 79.5 | 17.1 | 19.7 | 8.6 | 6.9 | 10.3 | 56.8 | 0.87 | 0.25 | 0.44 | 0.35 | 0.13 | 0.71 |
| MZFC 12231 | 84 | 17.8 | 20.9 | 9 | 7.3 | 11 | 60.8 | 0.85 | 0.25 | 0.43 | 0.35 | 0.13 | 0.72 |
| MZFC 7093 | 88.5 | 17.9 | 20.5 | 10 | 7.5 | 10.5 | 61 | 0.87 | 0.23 | 0.49 | 0.37 | 0.12 | 0.69 |
| MZFC 7094 | 95.5 | 20.3 | 22.9 | 11 | 8.3 | 12.5 | 68.6 | 0.89 | 0.24 | 0.48 | 0.36 | 0.13 | 0.72 |
| MZFC 7098 | 102 | 21 | 24.1 | 11.7 | 8.5 | 13.4 | 73 | 0.87 | 0.24 | 0.49 | 0.35 | 0.13 | 0.72 |
| MZFC 7097 | 103 | 23.4 | 26.9 | 12 | 9.5 | 15.1 | 80.2 | 0.87 | 0.26 | 0.45 | 0.35 | 0.15 | 0.78 |
| UTACV R-46031 | 103.2 | 23.1 | 25.9 | 11.6 | 8.4 | 14.4 | 81.2 | 0.89 | 0.25 | 0.45 | 0.32 | 0.14 | 0.79 |
| MZFC 7095 | 109.2 | 23 | 27 | 11.4 | 9 | — | 84 | 0.85 | 0.25 | 0.42 | 0.33 | — | 0.77 |
| MZFC 12223 | 109.5 | 24.4 | 27.5 | 12.4 | 9.3 | 15.9 | 85 | 0.89 | 0.25 | 0.45 | 0.34 | 0.15 | 0.78 |
| MZFC 12224 | 113.2 | 24.1 | 28 | 13.2 | 9 | 16.1 | 92.8 | 0.86 | 0.25 | 0.47 | 0.32 | 0.14 | 0.82 |
| MZFC 12225 | 102 | 23.3 | 24.9 | 13.2 | 8.2 | 15.3 | 76.5 | 0.94 | 0.24 | 0.53 | 0.33 | 0.15 | 0.75 |
| $\bar{x}$ | 97.4 | 21.5 | 24.5 | 11.5 | 8.4 | 13.5 | 74.5 | 0.88 | 0.25 | 0.47 | 0.34 | 0.14 | 0.75 |
| 1 SE | 3.426 | 0.759 | 0.839 | 0.458 | 0.235 | 0.649 | 3.486 | 0.007 | 0.007 | 0.010 | 0.004 | 0.005 | 0.012 |

[1] HW = head width; HL = head length; HH = head height; SNL = snout length; SHL = shank length; TL = tail length.
[2] Excluding juveniles.

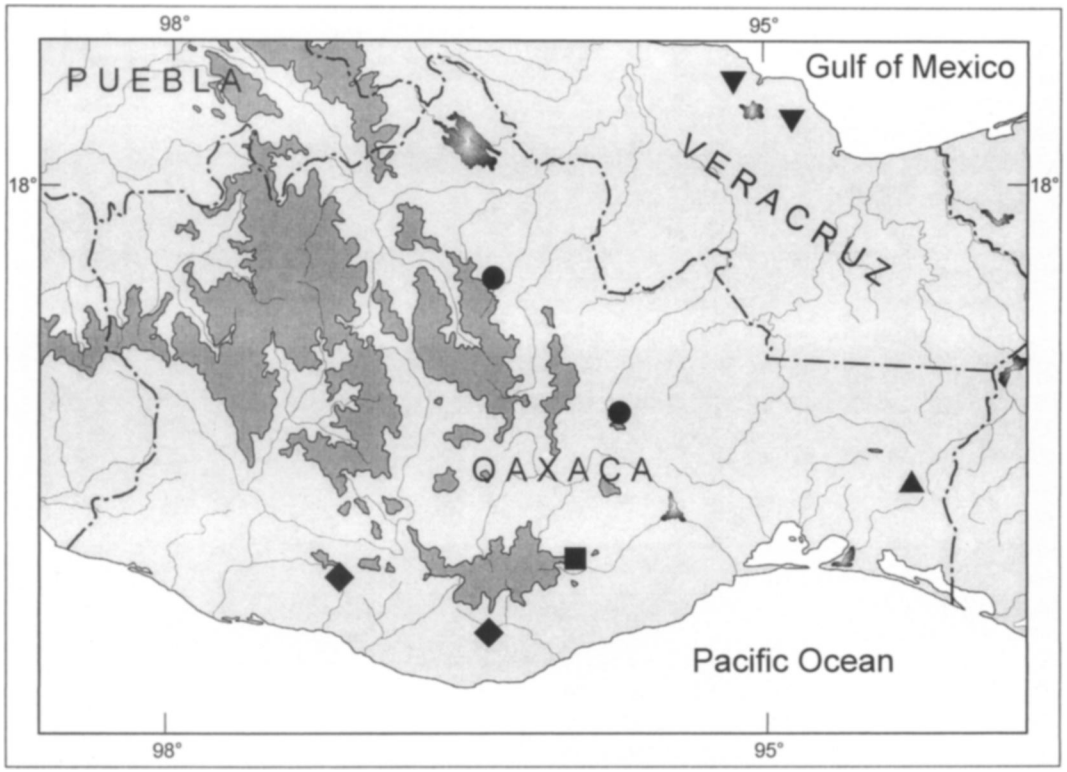


FIG. 3.—Geographic distribution of *Xenosaurus phalaroanthereon*. Discontinuous lines represent state limits. Uniformly shaded areas represent elevations >2000 m. Gradient-shaded areas represent water bodies. The square represents the species' type locality. Inverted triangles, circles, diamonds, and triangle represent the geographic distributions of *X. grandis sanmartinensis*, intergrades of *X. g. grandis* with *X. g. rackhami*, *X. g. agrenon*, and *X. g. arboreus*, respectively.

replaced by oak forest. The climate at the type-locality region is warm (mean annual temperature between 18 and 22 C; mean annual temperature of the coldest and warmest month between −3 and 18 C and >6.5 C, respectively), subhumid, with most rainfall falling in summer and <5% of the annual rainfall falling in winter.

*Etymology.*—The name *phalaroanthereon* is formed from the Greek words *phalaros* (white-spotted) and *anthereon* (chin). The name is in reference to the distinctive white chin spots of this species.

*Life history.*—Three juveniles (SVL 60.6–70.9) were collected on 27 February 1999, and another one (SVL 73.5) on 27 March 1995. Several adults and subadults also were collected on each of these dates.

*Remarks.*—There is little doubt that the rostral grooves present in most paratypes were also present in the holotype, if this scale were not damaged. These grooves are present in all paratypes in which the rostral was not damaged (intact on one side in two specimens with rostral partially damaged; not visible only in one specimen with rostral skin damaged on both sides).

Ontogenetic variation in the development of head and limb tubercles is evident. Large, adult specimens usually have large, pointed, conical tubercles, whereas juveniles have large, slightly convex, blunt tubercles. Also, in two out of the three juveniles the posteriormost pale caudal rings are white. This condition is also found in a subadult specimen with a broken tail, but not seen in any of the adults (pale caudal rings cream). Thus, there seems to be a trend for this character to vary ontogenetically as well.

FIG. 4.—Habitat of *Xenosaurus phalaroanthereon* at the type locality.

## DISCUSSION

Although the morphological distinctness of *Xenosaurus phalaroanthereon* had been formerly noticed by Smith and Iverson (1993), these authors provided no data for the diagnosis of this species. *Xenosaurus phalaroanthereon* possesses at least one unique character for the genus: namely, the presence of white spots on the infralabial-labiomental region. Furthermore, *X. phalaroanthereon* also possesses a unique combination of other characters, including a medial postrostral with a straight, transverse posterior margin, the second chinshields in medial contact anteriorly, a low number of lamellae under the fourth toe, an essentially immaculate venter, a pale middorsal spot on the anteriormost dark caudal ring, and a relatively short tail.

*Xenosaurus phalaroanthereon* is allopatric from other species in the genus. The nearest species to the type-locality is *X. grandis agrenon* from the southernmost portion of Oaxaca (Cafetal Alemania, near Pluma Hidalgo), approximately 60 km (straight line) to the southwest (King and Thompson, 1968). However, the area between these two localities has not been adequately surveyed because of the absence of access roads. Excluding Cafetal Alemania, the nearest records of *Xenosaurus* to San Juan Acaltepec are San Lucas Camotlán (intergrade between *X. g. grandis* and *X. g. rackhami* sensu King and Thompson, 1968), Río Sal, Lachao, Juquila (type-locality of *X. g. agrenon*), and the Sierra Madre north of Zanatepec (type locality of *X. g. arboreus*).

Without an explicit phylogenetic analysis, relationships of *Xenosaurus phalaroanthereon* to other species in the genus are speculative. Overall, the species is clearly more similar to *X. rectocollaris* in both scutellation (e.g., canthus temporalis rounded, postocular and zygomatic ridges narrowly in contact throughout their length, a low number of lamellae under the fourth toe) and color pattern (e.g., distinct postparietal dark marks present, nape collar essentially transverse, restricted to the posterior half of the nape and separated from the postparietal marks, transverse body bands not extending onto the lateral fold, immaculate venter) than it is to the populations of the *X. grandis* complex, the northern species of the genus (*X. platyceps* and *X. newmanorum*), or *X. penai*. However, it should be noted that, aside from *X. phalaroanthereon*, the only species that frequently has second chinshields in medial contact is *X. g. agrenon* from the Sierra Madre del Sur in Oaxaca, and that this is the only other species that overlaps at all with *X. phalaroanthereon* in tail length.

If *Xenosaurus phalaroanthereon* is the actual sister taxon of *X. rectocollaris*, this would be congruent with biogeographic patterns known in other groups occurring in this region. There are examples of species from the Sierra Madre del Sur in Guerrero and Oaxaca being more closely related to other species in western Mexico and the central valleys of Puebla and Oaxaca as opposed to being related to those in the Atlantic versant of Mexico and Guatemala. For instance, *Anolis nebuloides*, which occurs in the Sierra Madre del Sur in Oaxaca, is thought to have as its nearest relative *A. megapholidotus* from the Sierra Madre del Sur in Guerrero, and to be more distantly related to species in the Atlantic versant of Mexico and Guatemala (e.g., the *A. schiedii* group; Lieb, 1981). Similarly, *Sceloporus spinosus caeruleopunctatus*, from the central valley and Sierra Madre del Sur in Oaxaca (see Smith and Chiszar, 1992), is more closely related to *S. horridus* from southern Morelos, Puebla, and western Mexico than to other populations of *S. spinosus* (Wiens and Reeder, 1997).

In addition to the characters used for *Xenosaurus* by King and Thompson (1968) and Smith and Iverson (1993), other characters were found in this study that seem to be of potential taxonomic importance in the genus. These characters include the medial contact or separation of the enlarged internasals, the number of scale rows between the largest supraoculars row and both the supraorbital semicircles (one or two) and the superciliaries (two or three), the maximum number of loreal scales between the canthus rostralis and

the supraocular row (1–3), the medial contact or separation of the second chinshields, and the position of the labiomental row (adjacent to the infralabial row throughout its length except for a few, interspersed, isolated scales in some taxa such as *X. grandis arboreus*; separated by a scale row in other taxa). Other potentially useful characters include the color of the dark caudal rings (dark orange with black margins in some species, entirely black in others) and the shape of the anteriormost caudal band.

## Resumen

Se describe una nueva especie de *Xenosaurus* de la Sierra Madre del Sur en Oaxaca y se compara con todas las demás especies en el género. La nueva especie difiere de las otras por tener 2–6 puntos blancos en la región infralabial-labiomentonal en cada lado de la cabeza, así como la siguiente combinación de caracteres: segundos escudos geniales usualmente en contacto medial uno con el otro, pocas escamas subdigitales en el cuarto dedo de la extremidad posterior (19–22, $\bar{x}$ = 19.4) y cola relativamente corta (proporción longitud de la cola/longitud hocico-cloaca 0.73–0.79). La nueva especie se colectó en grietas de rocas en bosque de encino a aproximadamente 2000 m de elevación, y es más similar a *X. rectocollaris* del sureste de Puebla.

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## Appendix I

### *Specimens Examined*

*Xenosaurus grandis agrenon:* MEXICO: *Oaxaca:* Río Sal, Lachao, Juquila [UIMNH 69375 (holotype), 69373–74, 69376 (paratypes); UCM 41821, 44475–78]; 1 km N Río Sal (MZFC 9541–44); 2 km E Río Sal (MZFC 9545).

*Xenosaurus grandis arboreus:* MEXICO: *Oaxaca:* North Zanatepec (UCM 39889); the summit of the Sierra Madre, above Zanatepec (UIMNH 56576, holotype); the summit of the Sierra Madre, near Zana-

tepec (UIMNH 56158, paratype); Sierra Madre, N of Zanatepec (UIMNH 56577–78, paratypes).

*Xenosaurus grandis grandis:* MEXICO: *Veracruz:* Cuautlapan [MZFC 5920 (3 specimens), 6889–91, 6895–98, 9510]; on road from Cuautlapan to Orizaba (MZFC 6892–94).

*Xenosaurus grandis rackhami:* GUATEMALA: *Alta Verapaz:* Finca El Volcán (UTACV R-24844–45); MEXICO: *Chiapas:* Selvas El Ocote (CFSHER 34, 100; MZFC 6886–87); km 23 on road from Ocozocoautla to Apic Pac (MZFC 6888); Predio Filadelfia, km 21.7 on road from Ocozocoautla to Apic Pac (MZFC 9552–56); NW Cintalapa (UTACV R-31031, 31066); Cerro del Sumidero, 10.7 mi N Tuxtla Gutiérrez (UCM 19028).

*Xenosaurus grandis grandis* × *X. grandis rackhami:* MEXICO: *Oaxaca:* Sierra de Juárez [MZFC 2159 (3 specimens)]; Santiago Comaltepec, km 88 on Mex Hwy 175 Tuxtepec-Oaxaca (MZFC 4510); Sierra Juárez, Santiago Comaltepec, La Esperanza (MZFC 4511, UTACV R-22214); Vistahermosa, km 78 on Mex Hwy 175 Tuxtepec–Oaxaca (MZFC 9548, 9550–51); N face Sierra Juárez, 1.6 km S Vistahermosa (UTACV R-12116, 12118); N face Sierra Juárez, 3.1 km S Vistahermosa (UTACV R-12120, 12124–25); N face Sierra Juárez, 4.8 km S Vistahermosa (UTACV R-12131); N face Sierra Juárez, 6.8 km S Vistahermosa (UTACV R-12134); Sierra Juárez, 3.4 mi. S Vistahermosa (UTACV R-8435); Sierra Juárez, 3.8 mi S Vistahermosa (UTACV R-8436); Ixtlán, Comaltepec, Vistahermosa (UCM 52487).

*Xenosaurus grandis sanmartinensis:* MEXICO: *Veracruz:* Los Tuxtlas (MZFC 4683); Los Tuxtlas, Sierra de Santa Martha (MZFC 6100); El Ariete-Barrava, Bastonal, Sierra de Santa Martha (UNAM-LT 2712–13); Bastonal, Sierra de Santa Martha (MZFC 9564, UNAM-LT 2794); La Asociación, Sierra de Santa Martha (UNAM-LT 2714, 2716); Azufrera, Sierra de Santa Martha (UNAM-LT 2715); crater of Volcán San Martín (MZFC 10553–54); Volcán San Martín (MZFC 9563, 9565; UTACV R-29979, 36582, UNAM-LT 2767).

*Xenosaurus newmanorum:* MEXICO: *San Luis Potosí:* Xilitla [MZFC 5928 (2 specimens), 10135]; about 7.2 km NE Xilitla (MZFC 7484); about 5 km N Xilitla, km 268 on road from Xilitla to Tamazunchale (MZFC 8451–55); km 7.2 on road from Xilitla to Tamazunchale (MZFC 6521).

*Xenosaurus penai:* MEXICO: *Guerrero:* Cerro Pico del Aguila (16° 57′ N, 98° 19′ W), Sierra de Malinaltepec (IBH 6414, holotype); foothills on E face Cerro Pico del Aguila (MZFC 7099, paratype); on road from El Terrero to Cerro Pico del Aguila [an adult female (MZFC 8479) and its litter (MZFC 7485–87, 8456); paratypes].

*Xenosaurus phalaroanthereon:* MEXICO: *Oaxaca:* Sierra Madre del Sur, Municipality of Santa María Ecatepec; about 4 km NE San Juan Acaltepec (MZFC 7093–95, 7097–98; UTACV R-46031–32); about 6.1 km SW San Juan Acaltepec (16° 14.93′ N, 95° 57.29′ W), 2005 m (MZFC 12223–24, 12226, 12228–31; UTACV R-46033).

*Xenosaurus platyceps:* MEXICO: *Tamaulipas:* km 25 on road from Jaumave to Ciudad Victoria [MZFC 5524 (2 specimens), 5543]; about 1.1 km NE from turnoff (sic), on old road to Rancho El Cielo (MZFC 8517); 3 km SE Estación Canindo, Reserva de la Biósfera Rancho El Cielo (MZFC 8518); on road from Gómez Farías to Ejido Azteca (MZFC 8519–21); 18.9 km SW Ciudad Victoria (MZFC 9557–60); 21.7 km W Ciudad Victoria, on Mexico Hwy 101 on road to Jaumave (MZFC 10051).

*Xenosaurus rectocollaris:* MEXICO: *Puebla:* 5 km NE Azumbilla, 28 air km NNE Tehuacán (MZFC 113); 9 km E Chapulco [MZFC 5719 (3 specimens)]; 8 km E Chapulco [MZFC 5923 (2 specimens), 5924, 7554, 9511–12); about km 10 on road from Tehuacán to Orizaba (MZFC 10046).