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**A REVIEW OF THE AMERICAN LIZARDS OF THE  
GENUS XENOSAURUS PETERS**

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# A REVIEW OF THE AMERICAN LIZARDS OF THE GENUS *XENOSAURUS* PETERS

WAYNE KING AND FRED G. THOMPSON<sup>1</sup>

**SYNOPSIS:** Analysis of the total observed range of variation in color and morphological characters in the lizards of the genus *Xenosaurus* from the available museum material permits the recognition of three species, *X. grandis*, *X. newmanorum*, and *X. platyceps* new species, which can be separated consistently from each other by a number of morphological and color characteristics. Both *X. newmanorum* and *X. platyceps* have restricted distributions in San Luis Potosí and Tamaulipas respectively, while *X. grandis* ranges from Veracruz south to the Pacific slopes of Oaxaca and east to Alta Verapaz. Over the wide distribution of *X. grandis*, five subspecies based on differences in color pattern are recognized, *X. g. grandis*, *X. g. sanmartinensis*, *X. g. rackhami*, *X. g. arboreus*, and *X. g. agrenon* new subspecies. The observed color variations and their possible derivation from a basic cross banded pattern are discussed.

## INTRODUCTION

With the addition of the two forms described here the genus *Xenosaurus* now contains seven named forms confined to México and Guatemala (Stuart, 1941; Taylor, 1949; Werler and Shannon, 1961; Lynch and Smith, 1965). Most of these forms were introduced in brief, isolated descriptions with no detailed discussion of previously known forms, largely because of the paucity of specimens in museum collections until recently. Consequently intraspecific morphological variation and interspecific relationships within the genus have been poorly understood. In the most recent review of the genus Lynch and Smith (1965) described a new species, *X. arboreus*, and relegated all other named forms to subspecific status (*X. g. grandis* (Gray), *X. g. newmanorum* Taylor, *X. g. rackhami* Stuart, and *X. g. sanmartinensis* Werler and Shannon), based on the examination of 4 speci-

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mens of *arboreus*, no specimens of *newmanorum*, no specimens of *sanmartinensis*, 2 specimens of *rackhami*, and 32 specimens of *grandis*. In view of recently collected material, we felt it was necessary to restudy the genus to the extent that available specimens permitted.

We examined over 200 specimens, representing all known forms, and the type specimens of all but *X. g. grandis* and *X. g. sanmartinensis*. On our determination of the range of variation of morphological and color characteristics in each form, we based our arrangements of species. We considered many characteristics, some of which we later discarded as being less than useful (e.g. number of lamellae under the fourth toe of the pes, length of the fourth toe, length of the limbs, and the relationship between these measurements and snout-vent length).

This is a monographic treatment of the genus. A key is provided at the end to aid in identifying the seven recognized forms. All diagnostic features within the genus are included in the key by numerical designation for each form. Most of our synonymies only list references subsequent to Smith and Taylor (1950).

#### ACKNOWLEDGMENTS AND ABBREVIATIONS

Designations of collections from which material was borrowed for this study are given below. We would like to thank the persons responsible for each of these collections for making their material available to us for our studies.

- AMNH — American Museum of Natural History
- DRP — Dennis R. Paulson, University of Washington
- FMNH — Field Museum of Natural History
- KU — University of Kansas Museum of Natural History
- LSUMZ — Louisiana State University Museum of Zoology
- MCZ — Museum of Comparative Zoology
- REE — Richard E. Etheridge, San Diego State College
- SM — Strecker Museum, Baylor University
- SUDSB — Stanford University, Division of Systematic Biology
- TCWC — Texas Cooperative Wildlife Collection, Texas Agricultural and Mechanical College
- TNHC — Texas Natural History Collection, University of Texas
- UCM — University of Colorado Museum
- UF — Florida State Museum, University of Florida
- TU — Tulane University
- UIMNH — University of Illinois, Museum of Natural History
- UMMZ — University of Michigan, Museum of Zoology
- USNM — U. S. National Museum

We also wish to thank Jon C. Staiger, Institute of Marine Science, University of Miami, for making the roentgenograms used in this study. Field work was supported by National Institutes of Health research grant GM 12300-1 (Fred G. Thompson, principal investigator).

## SYSTEMATICS

*Xenosaurus grandis* (Gray)

Because of the nature of its morphological and color characteristics, and the nearly contiguous geographical distributions of the forms involved, *X. grandis* is divisible into five subspecies. In meristic characters these subspecies share in common, or overlap in, a canthus temporalis distinctly developed as a longitudinal row of enlarged scales and conspicuously set off from smaller, rugose temporal scales; the presence of one or more paravertebral rows of enlarged tubercles; a longitudinal row of 3-5 enlarged hexagonal supraoculars that are wider than long; a head 0.55-0.67 times as high as wide, and 0.23-0.27 times the snout-vent length; a tail 0.81-1.10 times the snout-vent length; 31-38 transverse rows of ventral scales between the axilla and groin, 18-24 scales per row at the widest part of the belly; a total of 18-23 supralabials.

A hypothetical generalized color pattern and its differentiation into the subspecific patterns is illustrated diagrammatically in figure 1. The basic pattern consists of dark brown- to black-edged white crossbands with a medium brown ground color between the crossbands on the dorsum (fig. 1H). Modification of this pattern occurs through the break-up of the darker pigmented areas into spots, or through the anastomosing of the light groundcolor bands, or through the reduction of the groundcolor crossbands to small, sometimes obsolete dorsal blotches. All of the subspecies usually have a large V-shaped nape blotch that is attenuate posteriorly, although it is nearly obsolete in some specimens of one form. Three of the subspecies also have distinct ventral spots or bars.

In *X. g. grandis*, the dark margins of the light dorsal crossbands are usually unbroken. These dark margins continue onto the venter, where they break into a series of bars and spots (fig. 1A). In *X. g. sanmartinensis*, the dark margins of the light dorsal crossbands are not of uniform width, but tend to form chains of blotches, and may not be continuous. These dark margins fuse on the sides of the trunk, and the fused bands extend onto the venter. Dark pigment might occur in the light dorsal crossbands and break them into a series of light transverse bars (fig. 1B). In *X. g. rackhami*, the dark margins of the light dorsal crossbands are broken into a series of blotches, and more dark pigment has invaded the light dorsal crossbands reducing them to white spots, or completely obliterating the light crossbands (figs. 1C, D). The dark crossbars or spots on the venter are

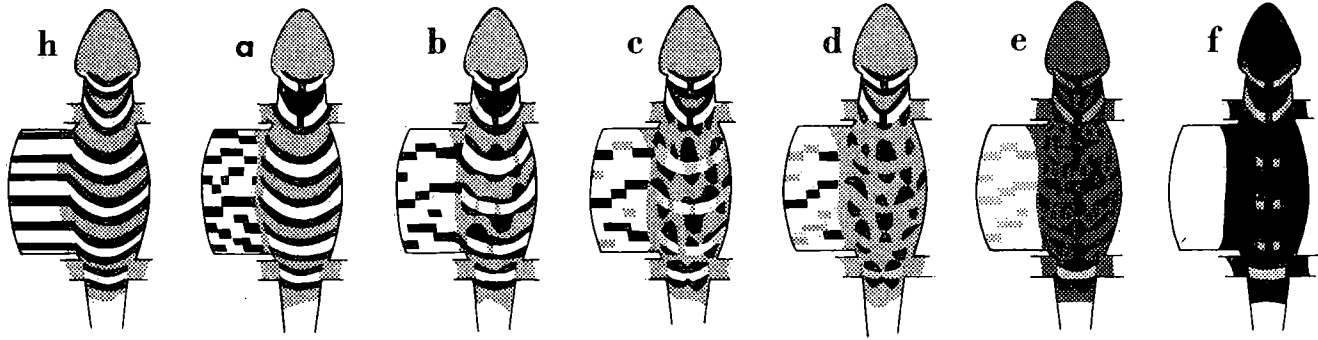


FIGURE 1. A simplified diagrammatic derivation of the *grandis* complex color patterns from a basic hypothetical pattern (h) consisting of dark-edged light crossbands on a medium brown dorsal groundcolor, with the dark edges of the crossbands continuing onto the light venter as crossbars. (a) The groundcolor between the light neck crossbands is obscured to produce the dark nape mark, and the ventral crossbands are broken in *X. g. grandis*. (b) The dark edges of the crossbands become blotchy, dark pigment invades the crossbands, and the number of ventral crossbars is reduced in *X. g. sanmartinensis*. (c) The groundcolor again appears in the nape mark, dark edges of the crossbands are broken into blotches, pigment further invades the crossbands to the extent that they may be obliterated (d), and the ventral markings are faded in *X. g. rackhami*. (e) The entire dorsal color is darkened when the dark edges of the crossbands fragment into diffuse spotting or a reticulate pattern in *X. g. agrenon*. (f) The dorsal surface is so dark that only the light neck marks and paravertebral remnants of the crossbands remain, and the ventral markings are absent in *X. g. arboreus*. No population has been found that conforms to the unmodified basic pattern (h). Compare this diagrammatic derivation with the actual markings in figure 2.

generally not as intensely pigmented. In *X. g. agrenon*, the pattern has been obscured by a general increase in dorsal pigment with the dark edges of the crossbands evident only as a diffuse reticulum (fig. 1E). In *X. g. arboreus*, the dorsal color is so dark that the light crossbands are reduced to a series of paravertebral spots or blotches (fig. 1F). The ventral pigment is reduced or absent.

In all of the named forms the ends of the subocular stripes extend onto the neck to produce a light crossband similar to those on the trunk. A second light crossband in the scapular region is also similar to the trunk crossbands. These two light crossbands on the neck enclose the dark mark on the nape. The dorsal groundcolor is evident in the center of this nape mark in *X. g. grandis* and *X. g. rackhami*. In the other subspecies, the dark margins to the crossbands have invaded the center of the interspace to produce a dark brown or black nape mark. This is a simplified presentation of the observed variation. As might be expected in a continuous gene pool, some of the above variations have been observed in the wrong populations. Compare the diagrammatic patterns in figure 1 with the actual patterns illustrated in figure 2.

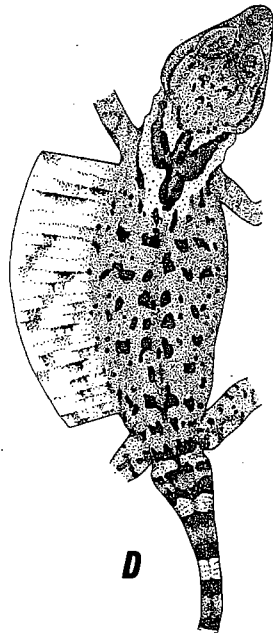
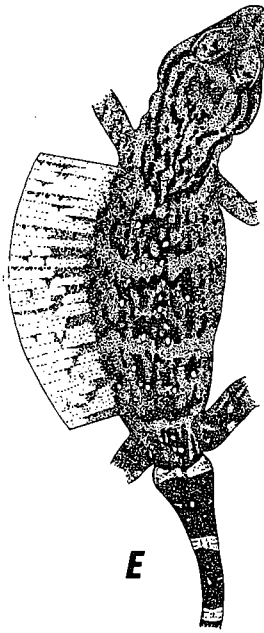
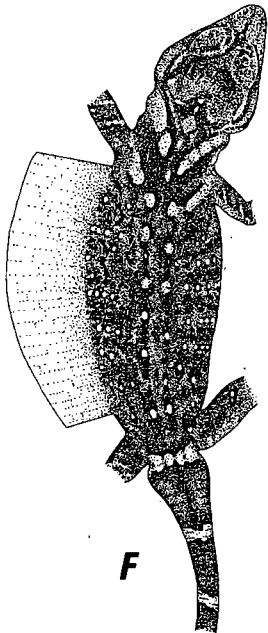
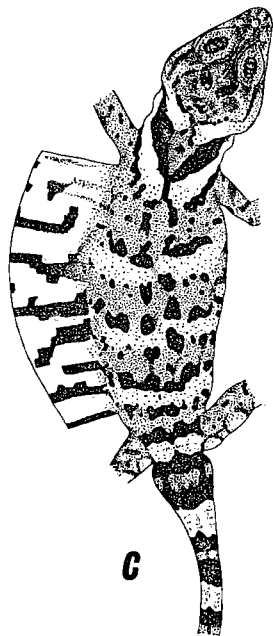
*Xenosaurus grandis grandis* (Gray)

(Figure 2A)

*Xenosaurus grandis*, Smith and Taylor, 1950.

*Xenosaurus grandis grandis*, Lynch and Smith, 1965.

**DESCRIPTION.** Medium sized, moderately stocky, moderately flattened. Head broadly triangular and thick. Snout moderately pointed. Head 0.84-0.95 times as wide as long, 0.55-0.61 times as high as wide, 0.23-0.27 times snout-vent length. Canthus temporalis weak but distinct, consisting of a series of slightly enlarged, imbricate scales set off from small granular temporal scales. Dorsal surface of head covered with small imbricate scales that form no distinct pattern. Rostral about equal to, or slightly less than, width of mental, about twice as wide as high. Nostril confined to a single large scale. Supralabials 9-12 on each side, totaling 18-23; moderately concave and weakly keeled in orbital region. Infralabials 9-12 on each side, totaling 19-22; flattened laterally, usually becoming strongly keeled posteriorly. Supraorbital semicircles consist of a series of slightly enlarged, strongly keeled scales, and are separated middorsally by a single row of scales. Superciliaries 10-13, and suboculars 11-14, on each side. Superciliaries and suboculars terminate abruptly at anterior corner of orbit. A longitudinal series of 3-4 enlarged hexagonal,





wider than long supraoculars present. Suboculars separated from supralabials by a longitudinal series of enlarged moderately keeled scales that may, or may not, continue dorsally to the canthus temporalis. Temporal region has conspicuously enlarged, high, conical tubercles separated from each other by 1-4 rows of minute granules. Tympanum covered with a membrane with small, flat, weak scales. Mental bounded posteriorly by two enlarged chinshields, each in contact with one or two infralabials, and followed posteriorly by two rows of enlarged scales that lie along the infralabials and over the mandibles. Throat covered with small granular scales that increase slightly in size in gular region. Gular fold well-developed. An additional small fold extends from the retroarticular region of the jaw to the scapular region. Chest covered with small, flat scales arranged in a reticulating series of short rows, or randomly arranged. Transverse rows of scales between axilla and groin, 32-38; 19-22 scales per row at widest part of belly. Preanal scales enlarged, separated from ventrals by 3-4 rows of smaller scales. A strong lateral fold extends from axilla to groin, decreasing in development posteriorly, and with numerous small folds and creases extending vertically from lateral fold. Tubercles on dorsal surface of body tending to be arranged in longitudinal series, but that pattern is generally obscured by lateral fold and creases. A paravertebral series of enlarged scales may be present, but the rows are frequently discontinuous. Enlarged tubercles on dorsal surface of arm separated from each other by 1-2 rows of minute granules. Tubercles on dorsal surface of thigh equal to, or slightly larger than, those on arm, but more widely spaced. Tail 0.86-1.10 times snout-vent length; cylindrical in cross section, very slightly laterally compressed.

Total length, 197-236 mm; snout-vent length, 96-116 mm; head length, 24.5-27.2 mm; head width, 20.2-25.6 mm; head thickness, 12.2-15.0 mm.

The groundcolor of the head is light to medium brown. The ventral edge of the posterior supralabials is dark brown to black. Dark

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FIGURE 2. Variation in the markings of adult *Xenosaurus grandis*. (A) *X. g. grandis*, SM 3224, Veracruz, near Cuautlapan; (B) *X. g. sanmartinensis*, TCWC 21481, Veracruz, Volcán San Martín; (C) *X. g. rackhami*, MCZ 54314, Chiapas, Ocozocoautla, Selvas el Ocote; (D) *X. g. rackhami*, UCM 19028, Chiapas, 10 mi N Tuxtla Gutierrez, Cerro del Sumidero; (E) *X. g. agrenon* holotype, UIMNH 69375, Oaxaca, Juquila, Lachas, Rio Sal; (F) *X. g. arboreus*, holotype, UIMNH 56576, Oaxaca, La Cumbre de la Sierra Madre, above Zanatepec. Relative sizes and positions of the specimens in this and the following figures are diagrammatic to facilitate comparison of color patterns.

parietal-occipital scales usually encircle a light interparietal scale. A light subocular stripe extends caudad to the neck where it swings toward the midline, but usually does not fuse with the one from the opposite side. This light subocular stripe is bordered above by a dark subcanthus temporalis stripe that approaches the one from the opposite side on the neck. The resulting paravertebral stripes join the dark nape mark. A dark brown to black V-shaped mark on the nape is bordered cranially by the light subocular stripes and caudally by a light brown to white chevron. The trunk groundcolor is medium brown. The trunk pattern consists of three or four dark brown- to black-edged light brown to white crossbands between the axilla and the groin. These crossbands usually cross the midline. The interspaces between the light crossbands have dark brown to black spots and vermiculations. In some specimens the dark spots invade the light crossbands and break them into a series of light bars or spots. In extreme conditions all that is left of the light crossbands are paravertebral white spots (UMMZ 88644). The tail is alternately ringed with light brown to white, and dark brown to black. The dark rings have light (medium brown) centers in some specimens. Ventrally the dark rings usually contain a primary light brown to white spot (figure 5C). The chin is uniform white. The chest is white and may have scattered dark scales. The venter is white to cream with dark brown to black scales. These scales may be arranged into narrow crossbars, the lateral ends of which are adjacent to the dark margins of the dorsal crossbands. The ventral crossbars usually number more than eight. A few specimens have faded ventral markings, but evidence of these markings is usually present in the form of dark sutures between the scales.

**REMARKS.** This subspecies has a restricted distribution in central Veracruz. In gross morphology, scalation, and color pattern, it is the most generalized of the four subspecies *X. grandis*.

**TYPE LOCALITY.** Córdoba, Veracruz. **HOLOTYPE:** a specimen in the British Museum (Natural History); collected by A. Sallé.

**SPECIMENS EXAMINED.** Veracruz: near Córdoba (SM 12259); Cuautlapon (MCZ 46743-5; FMNH 38609-10, 102954-5, 112103-10, 122810-3, 123686-705; KU 26472, 27012-5, SUDSB 11047; UMMZ 88644 (13), 115095 (4); USNM 111525-49); near Cuautlapan (SM 3220-27, 3249); mountain immediately SE Cuautlapan (FMNH 71028); Cuautlapan, Cerro de Escorpiones (UIMNH 60089-93, 60095-116, 60118-20); just below Cuautlapan, Cerro de Chicahuastla (UIMNH 60121); W Fortín (SM 7855-62); Orizaba (USNM 6325); 4.2 mi S Orizaba (DRP 4070).

**ADDITIONAL RECORDS.** Veracruz: Huatusco (Smith and Taylor, 1950); 9 km SW Fortín (Lynch and Smith, 1965).

*Xenosaurus grandis sanmartinensis* Werler and Shannon  
(Figure 2B)

*Xenosaurus rackhami sanmartinensis* Werler and Shannon, 1961.

*Xenosaurus grandis sanmartinensis*, Lynch and Smith, 1965.

DESCRIPTION. Medium sized, moderately stocky, weakly compressed dorsoventrally. Head narrowly triangular. Snout rounded. Head 0.75-0.83 times as wide as long, 0.57-0.67 times as high as wide, 0.23-0.25 times snout-vent length. Canthus rostralis rounded; canthus temporalis well-developed, consisting of a series of enlarged elongate scales conspicuously set off from minute granules below. Dorsal head scales rugose, placoid, forming no distinct pattern. Rostral about 2-3 times as wide as high, about as large as mental scale. Nostril confined to a single large scale. Supralabials 9-12 on each side, totaling 19-23; moderately convex and rounded, becoming weakly keeled posteriorly. Infralabials 9-12 on each side, totaling 18-24; flattened laterally and with a very weak keel posteriorly. Supraorbital semicircles weakly demarcated from adjacent scales by forming slight crests, and separated middorsally by a single row of elongate granular scales. Superciliaries 10-13, and suboculars 10-13, on each side. Superciliaries and suboculars terminate abruptly at anterior corner of orbit. An elongate series of 3-4 enlarged hexagonal, wider than long supraoculars present. Suboculars separated from supralabials by a row of enlarged elongate, moderately keeled scales that originate just anterior to orbit and extend posteriorly and dorsally to the canthus temporalis. Temporal region with a few enlarged, sharp, conical tubercles separated from each other by 1-3 rows of minute granules. Tympanum covered by a rather thick membrane with small, granular scales. Mental bounded posteriorly by two chinshields, each in contact with one or two infralabials, and followed posteriorly by 3-4 rows of enlarged scales that cover the mandibles. Throat and gular region covered with minute imbricate granular scales. Gular fold well-developed. An additional weaker fold occurs on each side of the neck extending from the retroarticular region of the jaw to the scapular region. Chest covered with small flat scales arranged in oblique transverse series not separated midventrally. Transverse rows of scales from axilla to groin, 33-38; 18-20 scales per row at widest part of belly. Preanal scales enlarged, rhomboid, separated from ventrals by 3-5 rows of small scales. A weak lateral fold extending from axilla to groin, strongest developed in axillary region, nearly obsolete near groin. No distinct pattern formed by tubercles on sides of body. Tubercles arranged

in curved oblique, longitudinal rows on each side of vertebral column. Middorsal line lacking enlarged tubercles. Arms with enlarged tubercles on dorsal surface separated by 1-2 rows of minute granules. Tubercles on dorsal surface of leg larger than those on the arms and more widely spaced. Tail 0.88-1.03 times snout-vent length, cylindrical, only slightly higher than wide.

Total length, 177-222 mm; snout-vent length, 87-113 mm; head length, 20.1-26.5 mm; head width, 15.9-21.2 mm; thickness of head, 10.7-13.6 mm.

The groundcolor of the head is dark brown. The ventral edge of the posterior supralabials is dark brown to black. A tan to white subocular stripe extends posteriorly to the neck where it curves upward toward the midline, but usually does not fuse with the one from the opposite side. This light subocular stripe is bordered above by a dark subcanthus temporalis stripe that fuses with the one from the opposite side on the neck. The resulting vertebral stripe joins the dark nape mark. A medium brown to black V-shaped mark on the neck is bordered cranially by the light subocular stripes, and caudally by a tan to white chevron. The trunk groundcolor is medium brown. The trunk pattern consists of three or four dark brown- to black-edged light brown to white crossbands which are usually continuous across the midline, between the axilla and the groin. The interspaces between the light crossbands have dark spots and blotches. The dark edges of the crossbands tend to be broken into chains and blotches. These blotches may encroach upon the light crossbands and break them into a series of light bars. The tail is alternately banded or ringed with light brown to white and dark brown to black. The dark rings frequently have light (medium brown) centers. Ventrally the dark rings may contain a primary light spot (fig. 5c), or may be broken completely (especially in those individuals with light centers to the dark bands dorsally). The chin is uniform white to cream. The chest is white to cream, and may have scattered dark scales. The venter is cream to white, with medium brown to black scattered scales and large bars. The dark bars usually represent the fusion of two of the dark edges to the dorsal crossbands. There are usually five or six ventral dark bars, which in some individuals are faded, but evidence of these bars is usually present in the form of dark sutures between the scales.

REMARKS. This subspecies is a weakly differentiated form that tends to be intermediate in character between *X. g. grandis* and

*X. g. rackhami*, but is probably derived from the latter form. In color pattern it is intermediate between those two subspecies. It retains the continuous dark borders to its light crossbands as occurs in *grandis*, but the dark borders tend to break up into chains of blotches. Its ventral color pattern is similar to that of *rackhami*, and differs from that of *grandis* in that the transverse black bars, when evident, are fewer in number. *X. g. sanmartinensis* is also more similar to *rackhami* than *grandis* because of its narrow head and a more conspicuously developed canthus temporalis.

TYPE LOCALITY. Crater of Volcán San Martín, Veracruz, 5,000 feet elevation. HOLOTYPE: an adult female, 10540, in the Frederick A. Shannon Collection (now in the UIMNH collection); collected by Jack Reid and John E. Werler. PARATYPES: Frederick A. Shannon Collection 10532-47; same data as holotype.

SPECIMENS EXAMINED. Veracruz: Volcán San Martín (TNHC 27111; TCWC 21481); Crater of Volcán San Martín, 5,350 feet (UMMZ 118215); south slope of Volcán San Martín, 3,800 feet (UMMZ 118214 (8)).

*Xenosaurus grandis rackhami* Stuart  
(Figure 2C)

*Xenosaurus rackhami* Stuart, 1941; Smith and Taylor, 1950.

*Xenosaurus rackhami rackhami*, Werler and Shannon, 1961.

*Xenosaurus grandis rackhami*, Lynch and Smith, 1965.

DESCRIPTION. Medium sized, moderately stocky. Head narrowly triangular. Snout rounded. Head 0.73-0.83 times as wide as long, 0.59-0.66 times as high as wide, 0.23-0.26 times snout-vent length. Canthus temporalis well-developed, consisting of enlarged scales set off from small granular scales of temporal region. Dorsal surface of head covered with granular scales that form no distinct pattern. Rostral about 1/3 as high as wide, about as wide as mental scale. Nostril confined to a single large scale. Supralabials 10-12 on each side, totaling 21-23; moderately convex and forming a distinct crest only along the posterior third of the series. Infralabials 9-11 on each side, totaling 18-22; flattened laterally with a weak ventro-lateral angle that forms a weak keel posteriorly. Supraorbital semi-circles weak, but clearly developed, and separated middorsally by a single row of elongate granular scales. Superciliaries 9-14, and suboculars 11-16, on each side. Superciliaries and subocular rows abruptly terminate at anterior corner of orbit. A longitudinal row of 4-5 enlarged hexagonal, wider than long supraoculars present. Suboculars separated from supralabials by an enlarged row of scales that forms a low crest extending from the nostril to the canthus temporalis. Temporal region with enlarged conical tubercles sep-

arated from each other by 2-5 rows of minute granular scales. Tympanum covered by a thick membrane with relatively large flattened scales. Mental bounded posteriorly by two enlarged chinshields each in contact with one or two infralabials and followed posteriorly by 2-3 enlarged rows of scales that lie along the infralabials and over the mandibles. Throat and gular region covered with minute elongate granular scales. Gular fold well-developed. An additional fold extends from the retroarticular region of the jaw to the scapular region. Chest covered with small, flat scales arranged in oblique transverse rows not separated by a midventral line. Transverse rows of scales from axilla to groin, 31-37; 17-24 scales per row at widest part of belly. Preanal scales enlarged, separated from ventrals by 3-4 diminishing transverse rows of scales. A weak lateral fold extending from axilla to groin. Occasional additional small irregular folds extend vertically from lateral fold. Pattern of enlarged tubercles on sides of body obscured by lateral fold and creases. Dorso-lateral tubercles tend to be arranged in oblique longitudinal rows on either side of vertebral column. Other dorsal tubercles much reduced in size. Enlarged tubercles on dorsal surface of arm separated from each other by a single row of minute granular scales. Dorsal surface of legs with enlarged rounded tubercles separated from each other by 2-5 rows of minute granules. Tail 0.87-1.09 times snout-vent length.

Total length, 165-205 mm; snout-vent length, 94-100 mm; head length, 22.8-24.8 mm; head width, 17.6-20.6 mm; thickness of head, 10.8-13.1 mm.

The groundcolor of the head is light brown. The ventral edge of the posterior supralabials is dark brown to black. Dark brown to black occipital spots may be present. A light brown to white subocular stripe extends to the neck where it curves toward the midline and approaches the one from the opposite side. This light subocular stripe is bordered above by a dark brown to black subcanthus temporalis stripe and a series of dark spots on the neck. A medium brown V-shaped mark on the nape is bordered cranially by the light subocular stripes and caudally by a light brown to white chevron. The edges of this dark mark are usually dark brown to black. The trunk groundcolor is medium to light brown. The trunk pattern consists of three or four brown to white crossbands between the axilla and the groin; these crossbands are usually continuous across the midline, and their margins are marked by a series of dark brown to black blotches. In some specimens the

crossbands are as dark as the groundcolor, and the only evidence of crossbanding is in the arrangement of the dark blotches and spots. The tail is alternately ringed with light brown to white and medium brown to black rings. The dark rings characteristically have light (medium brown) centers. Ventrally the dark rings contain a primary white spot or blotch (fig. 5c). The chin is uniform white to cream. The venter is white to cream with light brown to black crossbars. The lateral ends of the crossbars are adjacent to, but fewer in number than, the dorsal series of dark blotches. In some individuals the dark ventral markings are faded due to ontogenetic changes, but evidence of these markings is usually present in the form of dark sutures between the scales.

REMARKS. This subspecies is highly variable in its color pattern, although it is consistent within the broad limits outlined above and in the key below. Meristic characters, other than head width, broadly overlap those that occur in *grandis*.

Stuart (1941: 48) described *rackhami* as a distinct species because insufficient material was available at that time to show intergradation with *grandis*, but he emphasized the weak differentiation between the two forms. Lynch and Smith (1965: 171) reduced *rackhami* to subspecific status because of its close similarities to *grandis*, although they had not examined any specimens that they considered intergrades.

It may still be argued that *rackhami* and *grandis* are distinct species because of the differences in head width. No overlap in this character is apparent in any of the specimens of both forms that we have examined, but we consider them as conspecific because of the similarities and overlaps that occur in all other characters.

Two specimens of *Xenosaurus* from Oaxaca, one from San Lucas Camotlán (USNM 123705), and the other from Campamento Vista Hermosa (KU 87437), retain the narrow head that typifies *rackhami*, although they intergrade in all other characters between *rackhami* and *grandis*, and particularly in the color patterns. There still remains a geographic break between the known ranges of *grandis* and the northwesternmost records of specimens identifiable as *rackhami* on the basis of head width, but future collecting will probably establish the presence of intervening and intermediate populations.

TYPE LOCALITY. Finca Volcán, 49 km east of Cobán, Alta Verapaz, Guatemala, 4,000 feet elevation. HOLOTYPE: UMMZ 89072, an adult female; collected by L. C. Stuart.

SPECIMENS EXAMINED. In addition to the type we have examined the following material. Chiapas: Cerro del Sumidero, 10.7 mi. N Tuxtla Gutierrez

(UCM 19028); Monte Cristo, Cerro del Sumidero, 1,300 m (MCZ 54306); Selva de Ocote, Ocozocoautla (MCZ 54308-9, 54312-4, 54317-8; AMNH 71394).

The following specimens we consider to be intergrades with *X. g. grandis*. Oaxaca: San Lucas Camotlán (USNM 123705); Campamento Vista Hermosa, about 20 km SSW Valle Nacional (KU 87437).

ADDITIONAL RECORD: Chiapas: Santa Rosa, near Comitán (Smith, 1949: 43).

*Xenosaurus grandis arboreus* Lynch and Smith

(Figure 2F)

*Xenosaurus arboreus* Lynch and Smith, 1965.

DESCRIPTION. Relatively small, stocky. Head broadly triangular, thick. Snout bluntly pointed or rounded. Head 0.82-0.89 times as wide as long, 0.56-0.63 times as high as wide, 0.23-0.24 times snout-vent length. Temporal region rounded, but has a weak canthus temporalis, consisting of a longitudinal postorbital series of enlarged scales distinctly set off from minute granular scales below. Dorsal head scales rugose, not forming a distinct pattern. Rostral about equal to, or slightly less than, width of mental. Nostril confined to a single large scale. Supralabials 10-12 on each side, totaling 22-23; convex, moderately keeled, decreasing in width posteriorly. Infralabials 10-11 on each side, totaling 20-22; flat sided, becoming strongly keeled posteriorly. Supraorbital semicircles consist of a series of rugose, strongly keeled scales, and may be in contact middorsally or may be separated by a single row of scales. Superciliaries 10-13, and suboculars 11-14, on each side. Superciliaries and suboculars terminate at anterior corner of orbit. A longitudinal series of 3-4 enlarged hexagonal, wider than long, supraoculars present. Suboculars separated from supralabials by a longitudinal series of scales that originate in the loreal region and terminate immediately behind the orbits, or may curve up to the canthus temporalis. Temporal region with large, rounded conical tubercles separated from each other and the canthus temporalis by 1-4 rows of minute granules. Tympanum covered by a thick membrane with small, granular scales. Mental followed posteriorly by two enlarged chinshields, each in contact with one or two infralabials on each side, and followed posteriorly by two rows of enlarged scales that lie over the mandibles. Throat and gular region covered with small elongate granular scales that are arranged in oblique longitudinal rows, and become slightly enlarged posteriorly. Gular fold well-developed. An additional weak fold extends from the retroarticular region of the jaw to the scapular region (its exact nature could not be determined because of the poor state of preservation of the type specimens). Chest covered



with flat, relatively large scales arranged in oblique transverse series, but not separated midventrally. Transverse rows of scales between axilla and groin, 34-37; 21-23 scales per row at widest part of belly. Preanal scales slightly enlarged, separated from ventrals by 2-3 rows of smaller scales. A well-developed lateral fold extends from axilla to groin. Tubercles above lateral line primarily arranged in oblique longitudinal series, and secondarily in vertical rows. Paravertebral rows of enlarged tubercles present. Enlarged tubercles on dorsal surface of arm separated from each other by 1-2 rows of minute granules. Tubercles on dorsal surface of legs about equal to those on arms, but more widely spaced. Tail 0.81-0.88 times snout-vent length.

Total length, 179-181 mm; snout-vent length, 92-105 mm; head length, 21.5-23.2 mm; head width, 19.7-19.8 mm; thickness of head, 10.5-11.8 mm.

The groundcolor of the head is dark brown. The ventral edge of the posterior supralabials is black. An ill-defined light brown to white subocular band extends to the neck, where it curves toward the midline and approaches the one from the opposite side. In UIMNH 56158 this stripe is reduced to a row of white tubercles on the neck. This light subocular band is bordered above by a dark brown to black canthus temporalis stripe. A dark brown to black V-shaped mark on the neck is bordered cranially by the subocular stripe, and caudally by an ill-defined light brown to white chevron. The trunk groundcolor is dark brown to black. The trunk pattern consists of light brown to white paravertebral spots, each containing a tubercle, and light tubercle on the sides of the trunk aligned in rows across the body axis. The interspaces between the rows of light tubercles contain parallel rows of dark tubercles. The tail is alternately banded with white and dark brown to black crossbands, although the banding may be obscure in some specimens. The dark bands usually do not cross the ventral surface of the tail (fig. 5d). The chin, chest, and venter are white to dusky gray.

REMARKS. In their description Lynch and Smith state that *arboreus* can be distinguished by its relatively short tail, the scattered light tubercles on the dorsum, and its being the only species of *Xenosaurus* on the Pacific slopes of Mexico. The tail of *arboreus* is reported to be less than 0.82 times the snout-vent length, whereas that of other species is 1.00 times the snout-vent length, or more. Table 1 of their publication shows that only two of the four types specimens of *arboreus* have complete tails. Even so, occasional specimens of

*g. grandis*, *g. rackhami*, and *g. sanmartinensis* have short tails (see Table 1 below). Also, our examination of one of the paratypes (UIMNH 56577) indicates this specimen has a tail of 0.88 times the snout-vent length. The light flecks on the trunk are not scattered, but are arranged in transverse series and represent the remnants of the light dorsal crossbands present in *g. grandis* (see figs. 1f and 2E, and the discussion of pattern variation within *g. grandis*). The pattern of *arboreus* is not so far removed from the typical *g. grandis* pattern as it might seem. Some specimens of *g. grandis* are like *arboreus* in having the dorsal crossbands reduced to a series of paravertebral light spots (FMNH 12397; one of the series UMMZ 88644), or in having the ventral markings absent (FMNH 123688; UMMZ 115095, and two of the series UMMZ 88644). The only color characteristics we have found that will consistently separate *arboreus* from *g. grandis* is its general dark color that obscures the basic color pattern. Since we cannot completely separate *arboreus* from *grandis*, we consider it a subspecies of *grandis*.

TYPE LOCALITY. La Cumbre de la Sierra Madre, above Zanatepec, Oaxaca, about 4,500 feet elevation. HOLOTYPE: UIMNH 56576; collected by Thomas MacDougall, February, 1964. PARATYPES: UIMNH 56577-8, 56158; collected in the vicinity of the type locality.

*Xenosaurus grandis agrenon* new subspecies  
(Figure 2E)

DESCRIPTION. (Measurements and counts in parentheses pertain to the holotype). Relatively small, moderately stocky. Head broadly triangular, thick. Snout moderately pointed. Head 0.79-0.96 (0.87) times as wide as long, 0.52-0.59 (0.55) times as wide as high, 0.23-0.30 (0.25) times snout-vent length. Canthus temporalis weak, consisting of a longitudinal postorbital series of slightly enlarged scales distinctly set off from smaller granular temporal scales. Dorsal head scales rugose, not forming a distinct pattern. Rostral about equal to, or slightly less than width of mental. Nostril confined to a single large scale. Supralabials 11-13 (11-12) on each side, totaling 23-26 (23); convex, moderately keeled in the orbital region. Infralabials 9-11 (11-10) on each side, totaling 18-21 (21); flat-sided, becoming strongly keeled posteriorly. Supraorbital semicircles consist of a series of rugose, strongly keeled scales, that may be in contact mid-dorsally or separated by a single row of scales. Superciliaries 11-13 (12-13), and suboculars 10-13 (10), on each side. Superciliaries and suboculars terminate abruptly at anterior corner of orbit. A longitudinal series of 3-4 enlarged hexagonal, wider than long,

supraoculars present. Suboculars separated from supralabials by a longitudinal series of scales that originate in the loreal region and terminate behind the orbits, or may curve up to the canthus temporalis. Temporal region with large, rounded conical tubercles separated from each other and the canthus temporalis by 1-4 rows of minute granules. Tympanum covered with a thick membrane with small, granular scales. Mental followed posteriorly by two large chinshields, each in contact with one or two infralabials on each side, and followed posteriorly by two rows of enlarged scales that lie over the mandibles. Throat and gular region covered with small elongate granular scales that are arranged in oblique longitudinal rows. Gular fold well-developed. An additional weak fold extends from the retroarticular region of the jaw to the scapular region. Chest covered with flat, relatively large scales arranged in oblique transverse series, but not separated midventrally. Transverse rows of scales between axilla and groin, 32-38 (36); 19-22 (22) scales per row at the widest part of belly. Preanal scales slightly enlarged, separated from ventrals by 2-3 rows of smaller scales. A well-developed lateral fold extends from axilla to groin. Tubercles above lateral fold primarily arranged in oblique longitudinal rows, and secondarily in transverse rows. Paravertebral rows of enlarged tubercles present. Enlarged tubercles on dorsal surface of arm separated from each other by 1-2 rows of minute granules. Tubercles on dorsal surface of legs about equal to those on arms, but more widely spaced. Tail 0.78-0.97 (0.87) times snout-vent length.

Total length, 150-186 (186) mm; snout-vent length, 73-102 (99) mm; head length, 22.0-25.3 (25.3) mm; head width, 17.5-22.7 (22.0) mm; thickness of head, 9.4-12.1 (12.1) mm.

The groundcolor of the head is dark brown. The ventral edge of the posterior supralabials is black. A light brown subocular stripe extends caudad to the neck where it swings toward the midline and usually fuses with the one from the opposite side. The light subocular stripe is bordered above by a dark brown to black subcanthus temporalis stripe that ends abruptly above the tympanum. A dark brown to black W-shaped mark on the neck is bordered cranially by the subocular stripe, and caudally by a sharp to ill-defined light brown chevron. The trunk groundcolor is medium to dark brown. The trunk pattern consists of three to four black-edged medium brown crossbands between the axilla and the groin, which may be continuous across the midline, but are characteristically broken into

blotches. In UIMNH 69374-69376, the dark edges to the crossbands are broken into diffuse spots which are fused into a crude reticulate pattern. In UIMNH 69373, the dark edges of the crossbands and the derived black reticulum are so broad and dense that only remnants of the light crossbands remain as light blotches. The tubercles within these light blotches are light brown to white. The tail is alternately banded with light brown and dark brown to black crossbands. Ventrally, the dark bands usually have light centers (fig. 5b) or contain a primary light spot (fig. 5c). There are usually more than six ventral dark bars, but in some specimens they may be obscure (such as in the holotype, UIMNH 69375), reduced (UIMNH 69376), or absent (AMNH 19383).

REMARKS. This subspecies apparently belongs to the *X. grandis* complex, but is intermediate in most characteristics between *arboreus* and *grandis*. It might be argued that specimens of *agrenon* are intergrades between those two forms except that the *agrenon* population is not intermediate in geographic location. However, *agrenon* may represent a genetically stable population that was derived from an intergrade population.

ETYMOLOGY. The name *agrenon*, from the Greek for net, refers to the color pattern.

TYPE LOCALITY. Rio Sal, Lachas, Juguila, Oaxaca. HOLOTYPE: UIMNH 69375, an adult female; collected by T. McDougall, March-May 1966. PARATYPES: UIMNH 69373-69374, 69376; same locality as holotype.

SPECIMENS EXAMINED. Oaxaca: ca. 3 mi S Tejocote, 7,600 feet (AMNH 91487); Cafetal Alemania, near Pluma Hidalgo (AMNH 19380, 19382-3).

### *Xenosaurus newmanorum* Taylor

(Figure 3)

*Xenosaurus newmanorum* Taylor, 1949; Martin, 1955 (in part).

*Xenosaurus grandis newmanorum*, Lynch and Smith, 1965.

DESCRIPTION. Medium sized, apparently more slender than other species because of narrowness of body in pectoral region and neck. Head large, thick, narrowly triangular. Snout rounded or very weakly pointed. Head 0.75-0.83 times as wide as long, 0.63-0.68 times as high as wide, 0.26-0.28 times snout-vent length. Canthus rostralis rounded; postorbital region rounded and lacking a canthus temporalis. Dorsal head scales small, imbricate, and not arranged in any definite pattern. Rostral about 2/3 as wide as, or equal to width of, mental. Nostril confined to a single large scale. Supralabials 11-15 on each side, totaling 24-29; strongly keeled through the length of the series. Infralabials 9-11 on each side, totaling 18-22; forming

a strong sublabial keel that becomes more intense posteriorly. Well defined supraorbital semicircles of elongate, strongly keeled scales and usually in contact middorsally, or rarely separated by a row of small granules. Superciliaries 10-12, and suboculars 10-13, on each side. Superciliaries and suboculars terminate at anterior corner of orbit. A longitudinal row of 2-3 enlarged rounded supraoculars

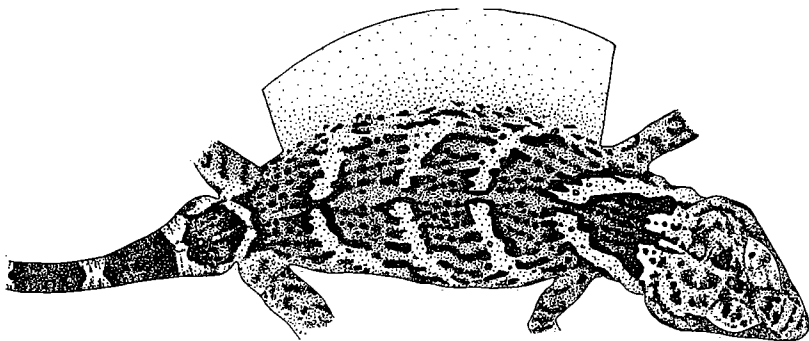


FIGURE 3. Markings of adult *Xenosaurus newmanorum*, UMMZ 126056, San Luis Potosí, 4.1 mi E Xilitla.

usually present. Suboculars separated from supralabials by a row of keeled scales that begins slightly behind the nostril and terminates before the posterior corner of the orbit. Temporal region covered with large, conical tubercles separated from each other by 1-2 rows of minute granules. Tympanic membrane very thin and naked, or with a few very small scales confined to the immediate margins. Mental followed posteriorly by two enlarged chinshields, each in contact with one or two infralabials and followed posteriorly by a radiating series of scale rows that overlay the mandibles. Throat covered with small elliptical scales that become slightly larger in the gular region. Gular fold well-developed. An additional fold extends from the retroarticular region of the jaw to the scapular region. Chest covered with small placoid scales arranged in oblique series not separated by midventral line. Transverse rows of ventral scales between axilla and groin, 33-36; 17-18 scales per row at widest part of belly. Preanal scales not quite as large as ventrals, separated from ventrals by 2-3 rows of smaller scales. A weak, frequently indistinct, lateral fold primarily confined to the anterior third or half of the body, and only vaguely indicated posteriorly by some enlarged tubercles. Sides of body covered with relatively

closely spaced large tubercles. Below the lateral fold the tubercles tend to be aligned with the ventral scales. Above the lateral fold the tubercles are arranged predominantly in oblique longitudinal series. Dorsal tubercles reduced in size. No distinct paravertebral rows of tubercles. Enlarged tubercles on dorsal surface of arm in contact with each other, not separated by minute granules. Tubercles on dorsal surface of legs slightly larger than those on arms, and separated from each other by 2-3 rows of minute granules. Tail 0.93-1.03 times snout-vent length, nearly cylindrical in cross section.

Total length, 190-237 mm; snout-vent length, 94-117 mm; head length, 24.7-30.5 mm; head width, 18.7-24.1 mm; head thickness, 12.3-16.4 mm.

The groundcolor of the head is light brown to ash-gray. The ventral edge of the posterior supralabials is dark brown to black. A dark subcanthus temporalis stripe extends from the eye posteriorly to the neck. Dark parietal-occipital marks encircle a light interparietal scale and approach, or fuse with, a dark occipital spot to form a dark oval. A light to medium-brown V-shaped mark on the nape is bordered cranially and caudally by light gray to white chevrons, and contains dark brown to black tubercles. The trunk groundcolor is light to medium brown. The trunk pattern consists of four (counting the one on the posterior edge of the nape mark) dark brown- to black-edged ash-gray to white crossbands from shoulder to groin, which do not cross the midline. The interspaces between the light crossbands have dark to black spots, each containing a tubercle. In most specimens these dark spots tend to fuse into short longitudinal stripes. The tail is alternately ringed with white to light brown, and dark brown to black. Ventrally the dark rings usually contain one primary and two secondary white spots (fig. 5e). The chin, chest, and venter are white to ash-gray.

REMARKS. This is a well-differentiated species that is readily distinguished from all other forms in the genus by numerous characteristics of scutellation and color pattern (see key below). Taylor (1949: 183) originally described *newmanorum* as a distinct species. Lynch and Smith (1965: 169-170) reduced it to subspecific status within *X. grandis*, without examining specimens of *newmanorum*. The material we have examined indicates that *newmanorum* is specifically distinct from all other forms and not close in its relationships to any one of them.

Martin's (1955: 174) discussion of the variation of *newmanorum* is unusable, for he combined data taken from Taylor's description

with data that he obtained from specimens that belong to the following species, which he confused with *newmanorum*.

TYPE LOCALITY. Xilitla region, San Luis Potosí. HOLOTYPE: LSUMZ 499. PARATYPES: LSUMZ 490, 491, 493-4, 497-8, 500-1, 504; KU 24043-7.

SPECIMENS EXAMINED. In addition to the type series we have examined the following specimens. San Luis Potosí: 4.1 mi E Xilitla (UMMZ 126051-7; UF 25006).

ADDITIONAL RECORDS. Specimens recorded by Martin (1955: 174) as *X. newmanorum* from Tamaulipas are not this species (see discussion of following species).

*Xenosaurus platyceps* new species

(Figure 4)

*Xenosaurus newmanorum*, Martin, 1955 (in part).

DESCRIPTION. (Measurements and counts in parentheses pertain to the holotype). Medium sized, moderately stocky, conspicuously flattened. Head sharply pointed, broadly triangular, flattened, 0.86-0.97 (0.90) times as wide as long, 0.47-0.54 (0.51) times as high as wide, 0.22-0.26 (0.26) times snout-vent length. Canthus rostralis angulate; postorbital region rounded, lacking a canthus temporalis demarcated by enlarged or well-defined scales. Head covered with granular, rugose scales that form no distinct pattern. Rostral about  $1/3$ - $2/3$  as wide as mental scale. Nostril confined to a single large scale. Supralabials 11-14 (14-14) on each side, totaling 23-28; protruding and becoming strongly keeled posteriorly. Infralabials 9-11 (11-11) on each side, totaling 19-22; forming a sublabial keel; increasing in size below and slightly behind orbits. Supraorbital semicircles form slightly raised crest, and are separated middorsally by a single row of granular, conical scales. Superciliaries 8-10 (9-9), and suboculars

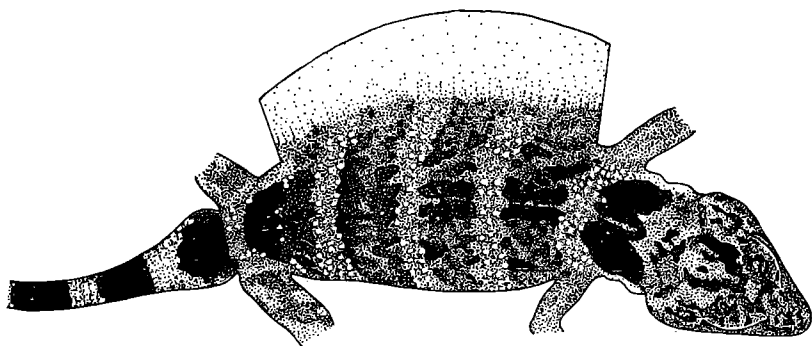


FIGURE 4. Markings of adult *Xenosaurus platyceps*, holotype, UMMZ 126048, Tamaulipas, 15.4 mi SSE Ciudad Victoria on road to Jaumave.

9-12 (11-11), on each side. Superciliaries and subocular rows join and extend forward along canthus rostralis for one or two scale lengths. A longitudinal series of 2-3 enlarged, rounded supraoculars usually present. Suboculars separated from supralabials by an enlarged series of scales that form a strong suborbital keel that terminates abruptly behind the orbit. Temporal region with enlarged, high, conical, sharply pointed scales separated from each other by 2-4 rows of minute granules. Tympanum covered with a feeble, scaled membrane. Mental bounded posteriorly by two enlarged chinshields, each in contact with 1-2 infralabials, and followed posteriorly by 4-5 rows of scales that lie along the infralabials and over the mandibles. Throat and gular region covered with minute elongate scales. Gular fold well-developed. An additional fold on each side of the neck extends from the retroarticular region of the jaw to the scapular region. Chest covered with small, flattened scales that tend to form oblique, transverse series separated by a midventral line. Transverse scale rows from axilla to groin, 40-42 (42); 20-23 (23) scales per row at widest part of belly (about one third of distance from groin). Preanal scales enlarged, separated from ventrals by 2-3 diminishing, transverse rows of scales. A weak lateral fold extends from axilla to groin. Sides of body with large, conical tubercles which are arranged in vertical rows that are continuous with ventral scale rows. Tubercles reduced in size and irregularly scattered dorsally where they become much more sparse; weakest in middorsal region. Arms with enlarged sharp, conical scales separated from each other by one or two rows of minute granules. Legs with similar enlarged scales separated by 2-5 rows of granules. Tail 0.92-1.13 (0.97) times snout-vent length; cylindrical; with 72-82 (79) rows of scales ventrally and 96-116 (108) rows dorsally due to division of every second or third ventral ring.

Total length, 152-214 (201) mm; snout-vent length, 77-111 (102) mm; head length, 20.2-26.3 (26.3) mm; head width, 17.2-24.5 (23.6) mm; thickness of head, 8.9-11.9 (11.9) mm.

The groundcolor of the head is light brown. The ventral edge of the posterior supralabials is dark brown to black. Dark brown to black parietal-occipital marks encircle a light interparietal scale, and with a dark occipital spot, produce a dark oval. A dark brown to black W-shaped mark on the nape. The trunk groundcolor is light to medium brown. The trunk pattern consists of dark brown to black blotches and vermiculations arranged in four crossbands between the axilla and the groin. These crossbands usually do not cross the midline, which produces a light vertebral stripe. Cream to enamel white



tubercles are present in the interspaces between the dark crossbands. The groundcolor between the tubercles confines the light color to the tubercles, and strongly contrasts them. The tail is alternately ringed with white and dark brown to black. Ventrally the dark rings contain a primary white spot (fig. 5c). The chin, chest, and venter are white, although the ventral scales of some specimens may be discolored by mineral and organic deposits acquired from the habitat of the lizards.

REMARKS. This is the most conspicuously differentiated species within the genus. The most striking features that separate *platyceps* from *grandis* and *newmanorum* are its flattened head, its low number of superciliaries, its high number of ventral transverse scale rows between the axilla and the groin, and its color pattern. These data, as well as others, are summarized in Table 1, and in the key below.

Martin (1955: 174) confused this species with *X. newmanorum*. His specimens (TU 15473, UMMZ 110739-40) clearly show the characteristic, but subtle features of the body flatness and tubercle arrangements. However, he lacked comparative material of typical *newmanorum* so that other characteristics of the scutellation and color pattern escaped his attention. Martin's summaries and tables cannot be used because they combine data from both *newmanorum* and *platyceps*.

ETYMOLOGY. The name *platyceps* is from the Greek and means flat head.

TYPE LOCALITY. Tamaulipas, 15.4 mi SSW Ciudad Victoria on road to Jaumave, 4,500 feet elevation. HOLOTYPE: UMMZ 126047; collected 16 August 1965 by Fred C. Thompson. PARATYPES: UMMZ 126044, 126045, 126046, 126048, 126049, 126050; UF 25005; REE 1791; all same data as the type.

SPECIMENS EXAMINED. Tamaulipas about 3 km SE La Joya de Salas and 30 km SSE Jaumave (UMMZ 110739-40); La Unión (TU 15473 (2)).

#### DISCUSSION

Several characteristics of the scutellation and color patterns are of such nature and constancy as to suggest that they may be used to separate species as well as to show phylogenies. In the past, these characteristics have not been given proper weight, because their significance is not apparent unless all of the forms are closely compared. Such comparisons are difficult to abstract from the existing literature.

Several scale characteristics consistently separate the species as we have arranged them. Within the *grandis* complex the development of the canthus temporalis as a well-differentiated longitudinal series

of enlarged scales, the well-developed, enlarged paravertebral rows of tubercles, and the enlarged hexagonal supraoculars are consistent in their presence and appearance, and indicate the forms of this complex are more closely related to each other than they are to other species. Conversely the absence of these characters from *newmanorum* and *platyceps* indicates neither are closely related to the *grandis* complex. In turn, they differ from each other in a number of characteristics, the total of which indicates they are not closely inter-related. These characteristics are summarized in table 1 and in the key presented below.

The dorsal color pattern of all three species of *Xenosaurus* consists of crossbands and a dark nape mark. In *grandis*, the light crossbands usually cross the midline. They may be broken into spots or bars, but as a rule they are complete and white or near white in color. In *newmanorum* the light crossbands almost never cross the midline, and are white in color. In *platyceps* the light crossbands cross the midline, but are not white; the white is confined to the tubercles in the light crossbands, while the band itself is the ground-color. In *grandis* the dark interspaces between the light crossbands contain dark blotches and large spots along their margins. In *newmanorum* the interspaces contain smaller spots than in *grandis*, and these spots tend to align in short longitudinal stripes. In *platyceps* the interspaces contain dark spots and blotches. Because the light

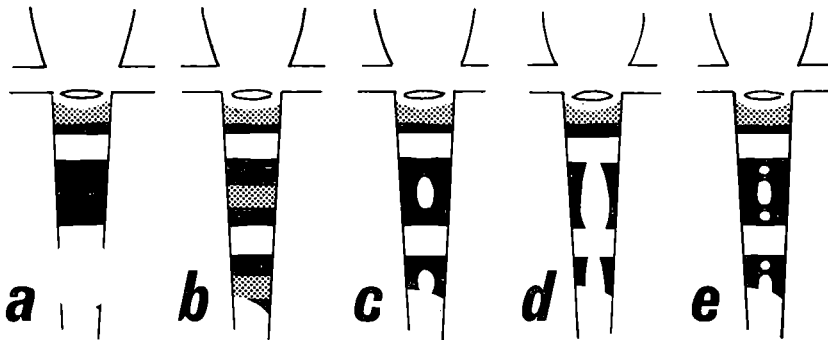


FIGURE 5. A diagrammatic representation of the ventral caudal markings of xenosaurs. The tail may be alternately ringed with dark and white rings (a) the dark rings may have light centers (b), may contain a primary light spot (c), may be broken (d), or may contain one primary and two secondary light spots (e). Patterns (a), (b), (c), and (d) occur in the *X. grandis* complex; (c) occurs in *X. platyceps*, and (e) occurs in *X. newmanorum*.

crossbands are the groundcolor, as is much of the interspaces, the dark markings give the impression of being dark crossbands rather than the interspaces between light crossbands. The dark spots in *platyceps* usually do not cross the midline, which results in a vertebral light stripe. The dark nape marks of *grandis* (excepting *agrenon*) and *newmanorum* are V-shaped, and bordered cranially by the ends of the light subocular stripes and caudally by the first light crossbands. In *platyceps* the nape mark is W-shaped, and is bordered caudally by the first light crossband, but is not bordered cranially by light subocular stripes. Light subocular stripes do not occur in *platyceps*.

The venters of *newmanorum* and *platyceps* are uniform white, with no exceptions. The venter of *grandis* is characteristically marked with dark scales arranged in a transverse pattern. Some specimens of *g. grandis*, and *g. arboreus* have a uniform white or light gray venter, but these are secondary conditions due to ontogenetic loss or genetic divergence.

The tail markings of all known *Xenosaurus* consist of alternating dark and light rings and bands. Ventrally, *grandis* and *platyceps* have the dark rings either complete or broken. Usually, however, the rings contain a single primary light spot (fig. 5c). In *newmanorum*, the dark rings usually contain a primary and two secondary light spots (fig. 5e).

The species and subspecies of *Xenosaurus* can be separated by means of the key below. The state of all fifteen characters used in the key are listed for each xenosaur, so the key may also be used as a diagnosis for each form.

#### KEY TO THE SPECIES AND SUBSPECIES OF *Xenosaurus*

- A. (1) Canthus temporalis present, consisting of a longitudinal series of enlarged scales that are distinct from the smaller granular scales of the temporal region. (2) Paravertebral rows of enlarged tubercles present. (3) A longitudinal row of 3-5 enlarged hexagonal supraoculars that are wider than long. (4) Venter usually with dark spots or markings, which may be indistinct or absent. *X. grandis* (Gray) ..... B
- AA. (1) Canthus temporalis lacking. (2) No well-defined paravertebral rows of enlarged tubercles. (3) Usually 2-3 enlarged rounded supraoculars forming a longitudinal row. (4) Venter uniform light gray to white in color ..... F
- B. (5) Head broadly triangular, 0.79-0.96 times as wide as long ..... C
- BB. (5) Head narrowly triangular, 0.73-0.83 times as wide as long ..... E
- C. (6) Tail 0.86-1.10 times snout-vent length. (7) Pattern of lateral tubercles obscured by small folds and creases in skin radiating from lateral

fold. (8) Chest scales arranged in reticulating series of short rows or randomly arranged. (4) Venter light-colored with dark spots that may form distinct ventrolateral bars.

*X. g. grandis* (Gray)

(9) Transverse light bands on body uniformly dull, frequently broken into spots and blotches. (10) Dark nape blotch V-shaped, pointed posteriorly. (11) Supraorbital semicircles separated by a single median row of scales. (12) Tympanum covered by a weakly-scaled membrane. (13) A strong fimbriated lateral fold extending from the axilla to the groin. (14) Enlarged tubercles on dorsal surface of arm separated from each other by 1-2 rows of minute granules. (15) Presacral vertebrae 28-30.

CC. (6) Tail 0.79-0.97 times snout-vent length. (7) Lateral tubercles arranged in oblique longitudinal series. (8) Chest scales arranged in oblique transverse series. (4) Venter uniform light gray in color, or with dark bars ..... D

D. (9) Dorsal groundcolor very dark, transverse light bands reduced even to obsolete paravertebral light spots, and with light tubercles arranged in transverse series. (10) Dark nape blotch obscured by general dark coloration, but V-shaped and pointed posteriorly. (4) Venter uniform light gray in color.

*X. g. arboreus* Lynch and Smith

(11) Supraorbital semicircles usually in contact, but may be separated by a single longitudinal row of scales. (12) Tympanum covered with minute, rugose, granular scales. (13) A well-defined lateral fold extends from axilla to groin. (14) Enlarged tubercles on dorsal surface of arm separated from each other by 1-2 rows of minute granules. (15) Presacral vertebrae 30-31.

DD. (9) Dorsal groundcolor medium to dark brown, transverse light bands usually present, but may be reduced to row of spots. (10) Dark nape blotch W-shaped and rounded posteriorly. (4) Venter usually with dark bars, which may be reduced or absent.

*X. g. agrenon* King and Thompson

(11) Supraorbital semicircles usually in contact, but may be separated by a single longitudinal row of scales. (12) Tympanum covered with small, granular scales. (13) A well-defined lateral fold extends from axilla to groin. (14) Enlarged tubercles on dorsal surface of arm separated from each other by 1-2 rows of minute granules. (15) Presacral vertebrae 28-30.

E. (9) Transverse light bands on body frequently no lighter than ground-color. Dark markings reduced to spots and blotches.

*X. g. rackhami* Stuart

(4) Venter cream to white with brown to black crossbars that are adjacent to, but fewer in number than, dorsal series of dark blotches. (6) Tail 0.87-1.09 times snout-vent length. (7) Lateral tubercles usually not arranged in any clear pattern. (8) Chest scales tending to be arranged in transverse rows that usually are not broken by a midventral line. (10) Dark V-shaped nape blotch, attenuate posteri-

only. (11) Supraorbital semicircles separated by a single middorsal scale row. (12) Tympanum covered with thin, granular scales. (13) A well-defined lateral fold extending from axilla to groin. (14) Enlarged tubercles on dorsal surface of arm separated from each other by a single row of minute granules. (15) Presacral vertebrae 28-29.

- EE. (9) Transverse light bands on body always lighter than groundcolor. Dark bands irregular, but continuous across dorsal surface.

*X. g. sanmartinensis* Werler and Shannon

(4) Venter with dark bars on a light background. In juveniles the dark markings extend from the sides as ventrolateral bars, but these become obscure in adults and are usually reduced or poorly defined. (6) Tail 0.88-1.03 times snout-vent length. (7) Lateral tubercles usually not forming a distinct pattern, but occasionally arranged in oblique rows. (8) Chest scales tending to be arranged in transverse rows that usually are not broken by a midventral line. (10) Dark V-shaped nape blotch, attenuate posteriorly. (11) Supraorbital semicircles separated by a single middorsal row of scales. (12) Tympanum covered with small, granular scales. (13) A weak, but complete lateral fold extending from axilla to groin. (14) Enlarged tubercles on dorsal surface of arm separated from each other by 1-2 rows of minute granules. (15) Presacral vertebrae 28.

- F. (5) Head narrowly triangular, 0.75-0.83 times as wide as long; thick, 0.63-0.68 times as high as wide; relatively long, 0.26-0.28 times snout-vent length. Transverse rows of scales between axilla and groin 33-37; scales per row at widest part of belly, 17-18. (11) Supraorbital semicircles in contact, not separated by a middorsal scale row. (12) Tympanum bare, without a thin, scaled membrane. (13) A weak, frequently indistinct, lateral fold that is confined to the anterior third or half of the body. (6) Tail 0.93-1.09 times snout-vent length. (7) Lateral tubercles predominantly arranged in oblique longitudinal series, and secondarily may tend to be aligned with ventral scale rows. (8) Chest scales tending to be arranged in transverse rows that usually are not broken by a midventral line. (14) Enlarged tubercles on dorsal surface of arm in contact with each other, not separated by minute granules. (9) Light crossbands on body not continuous across the midline. (10) Dark V-shaped nape blotch, attenuate and pointed posteriorly. (15) Presacral vertebrae 29.

*X. newmanorum* Taylor

- FF. (5) Head broadly triangular, 0.86-0.97 times as wide as long; flat, 0.47-0.54 times as high as wide; of average length, 0.22-0.26 times snout-vent length. Transverse scale rows between axilla and groin 40-42; scales per row at widest part of belly, 20-23. (11) Supraorbital semicircles separated by a single, median row of scales. (12) Tympanum covered by a thin, scaled membrane. (13) A strong lateral fold extending from axilla to groin, but not fimbriated. (6) Tail 0.92-1.13 times snout-vent length. (7) Lateral tubercles arranged in distinct vertical rows that are continuous with ventral scale rows. (8)

Chest scales arranged in distinct oblique transverse rows that are broken by a midventral line. (14) Enlarged tubercles on dorsal surface of arm separated from each other by 1-2 rows of minute granules. (9) Transverse light bands on body consisting of the groundcolor, continuous dorsally, and accentuated by enamel-white tubercles. (10) Dark nape blotch W-shaped, truncate posteriorly. (15) Presacral vertebrae 30-31.

*X. platyceps* King and Thompson

#### DISTRIBUTION OF XENOSAURUS

*Xenosaurus* is currently known from a large area of México and Guatemala, from Tamaulipas south and east to Alta Verapaz, and over a fairly large area of the Pacific slopes of Oaxaca. These lizards are found in areas of limestone and volcanic terrain from about 1,000 to 7,000 feet elevation.

It is reasonable to assume the genus has a wider geographic distribution in western México and Central America than is presently known. During recent years four new forms have come to light from habitats and areas considerably outside the previously known range of the genus. Large areas of Guerrero, Oaxaca, Chiapas, and Guatemala, proximal to the known range of the genus and including large areas of favorable habitat, have not been sufficiently worked. These lizards must be included in the likely-to-occur but unrecorded species for these areas.

*Xenosaurus* is known from a variety of ecological situations, ranging from nearly xerophytic to quasi-rainforest and cloud forest. The area of central Veracruz, where *X. g. grandis* is found, consists of limestone and volcanic terrain covered with semi-xerophytic and mesophytic vegetation. *Xenosaurus g. rackhami* is known from mesophytic and quasi-rainforest in areas of well-developed karst topography. *Xenosaurus g. sanmartinensis* has been found only in a restricted area in the volcanic Los Tuxtlas range of eastern Veracruz, where it occurs in rather dense cloud forests. *Xenosaurus newmanorum* is known only from a very small region in San Luis Potosi, which consists of rather dense quasi-rainforest on highly eroded karst limestone. *Xenosaurus platyceps* is known from a small area in Tamaulipas, where it is found in dry scrub forests and oak savanna on limestone terrain. *Xenosaurus g. arboreus* has been found in a small region of sparsely forested oak and pine on volcanic rocks. *Xenosaurus g. agrenon* has been collected in areas varying from mesophytic forest to xerophytic scrub, and on varied substrates.

These lizards have not been reported to be active during the day-

time, and the only occasion that the junior author has found them (*X. newmanorum*) active was just after dusk in a densely shaded ravine. On other occasions, *newmanorum* and *platyceps* were found in crevices and holes in limestone. It is generally known that *X. g. grandis* occurs in similar habitats, as probably does *X. g. rackhami*. Werler and Shannon (1961: 132) reported *X. g. sanmartinensis* to occur under volcanic boulders and in crevices in volcanic rock. Lynch and Smith (1965: 166) reported *X. g. arboreus* as occurring in hollow

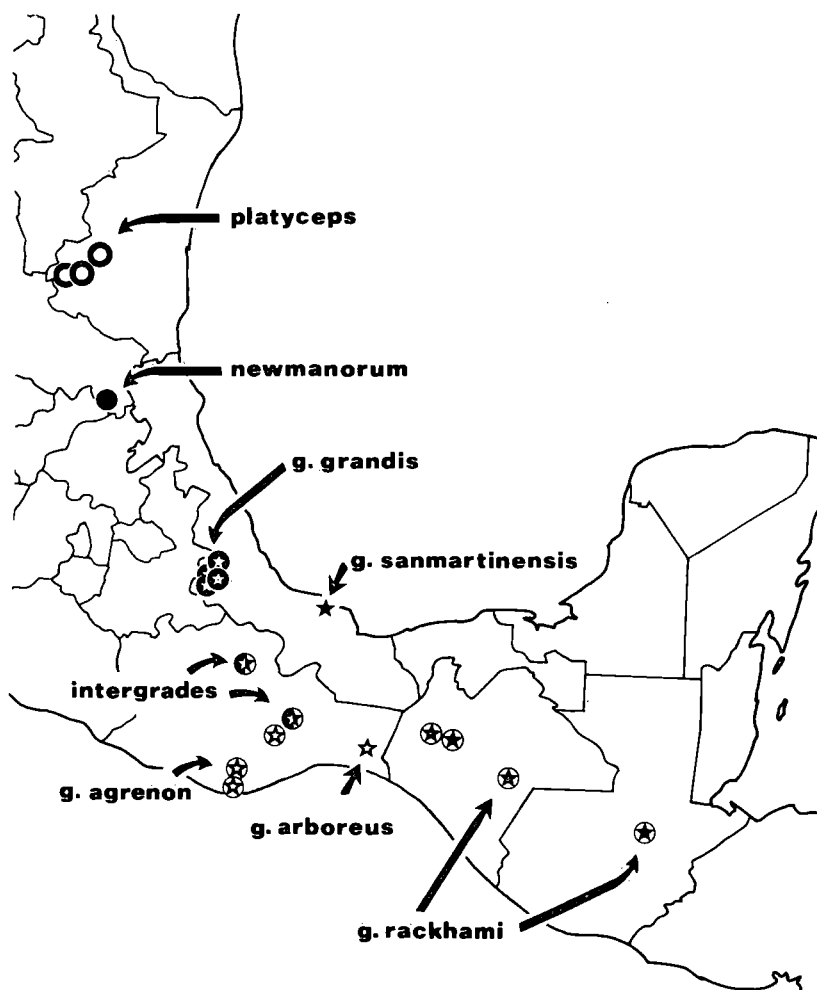


TABLE 1. Measurements and scale counts of *Xenosaurus*.

	<i>g. grandis</i>	<i>g. rackhami</i>	<i>g. sanmartinensis</i>	<i>g. agrenon</i>	<i>g. arboreus</i>	<i>newmanorum</i>	<i>platyceps</i>
<u>Tail</u>							
Snout-vent	0.86-1.10	0.87-1.09	0.88-1.03	0.78-0.97	0.81-0.88	0.93-1.03	0.92-1.13
<u>Head</u>							
Snout-vent	0.23-0.27	0.23-0.26	0.23-0.25	0.23-0.30	0.23-0.24	0.26-0.28	0.22-0.26
Head $\frac{\text{width}}{\text{length}}^*$	0.84-0.95	0.73-0.83	0.75-0.83	0.79-0.96	0.82-0.89	0.75-0.83	0.86-0.97
Head $\frac{\text{height}}{\text{length}}$	0.45-0.56	0.45-0.53	0.44-0.52	0.43-0.50	0.49-0.53	0.47-0.55	0.40-0.48
Head $\frac{\text{height}}{\text{width}}$	0.55-0.61	0.59-0.64	0.57-0.67	0.52-0.59	0.56-0.63	0.63-0.68	.47-0.54
Supralabials	9-12	10-12	9-12	11-13	10-12	11-15	11-14
Infralabials	9-12	9-11	9-12	9-11	10-11	8-11	9-11
Superciliaries	10-13	9-14	10-13	11-13	10-13	10-12	8-10
Suboculars	11-14	11-16	11-13	10-13	11-14	10-13	9-12
Transverse ventral scale rows (axilla to groin)	32-38	31-37	33-38	32-38	34-37	33-37	40-42
Scales per row	19-22	17-24	18-20	19-22	21-23	17-18	20-23

\*Head length was measured from the tip of the snout to the base of the occipital.



logs in dry areas where rocks are very numerous, but trees are sparse.

No food studies have been made on these lizards. Presumably, they feed on soft-bodied invertebrates, particularly arthropods, for roentgenograms failed to show hard objects such as mollusk shells, even in specimens that were found living among large numbers of land snails.

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