THE UNIVERSITY OF KANSAS
SCIENCE BULLETIN

VOL. XXXIV, PT. II] FEBRUARY 15, 1952 [NO. 14

Taxonomy and Distribution of the Horned Lizard Genus *Phrynosoma*

BY

WAYNE L. REEVE,
University of Kansas

ABSTRACT: The lizards of the genus *Phrynosoma* are treated monographically. Fourteen species are recognized with a total of 27 forms (species and subspecies). Considerable information is given on taxonomic history, osteology, habits, and speciation. A series of maps give a complete picture of the known distribution of each form. No new names are proposed, but one name, *Phrynosoma platyrhinos calidiarum*, is revived.

TABLE OF CONTENTS

INTRODUCTION

In reviewing the genus *Phrynosoma* taxonomically, I have sought to determine and describe the existing species and subspecies, provide ready means for recognizing the named forms, and to map the geographic distribution, as now known of each kind. Whether some named forms should be lumped together or whether additional variants should be described as new, had to be decided. This was done mostly on the basis of the worker's knowledge and his interpretations of the available data. Even so, personal opinion played some part. Questions that arose concerning the relationships of one form to another included the following: Were certain forms that lived in areas adjacent to each other species or subspecies? What were the characters that could be depended upon to show the true relationships of the kinds of lizards involved? It was soon found that no single set of criteria would suffice; characters that showed relationships of taxonomic worth in one case, seemed not to do so in another. In some instances various characters were given numerical "weights" which were recorded and the total weight of the characters for each kind of lizard was computed. In this

manner the different forms of lizards could be arranged in a definite sequence. Whether this is indicative of their true relationship might be questioned. However, when lizards were arranged by the "weight" system, the arrangement corresponded closely to the arrangement arrived at by other less exact means of estimating relationships of the same lizards. The maintenance of a constant attitude toward similar problems has been attempted throughout the paper.

METHODS AND MATERIALS.—I have attempted to make all the synonymies complete. However, in some instances it has been impossible to relegate positively each reference to its proper place owing to my inability to determine what species was being treated by the author. In such an instance placement was made in accordance with my own idea as to probability.

The descriptions have been made from a series of specimens where such were available and the average conditions of each character was recorded as if present on a single specimen. Under the topic variation, only a few characters that I consider salient have been discussed. It must be realized that more characters than those mentioned also vary. The descriptions of color and color pattern are from alcoholic specimens submerged in water.

Twenty-two measurements and twenty-one other items of data were recorded from each specimen handled. The measurements were made with a vernier caliper and all were taken by myself to assure as much uniformity as possible. The measurements found to be of most significance in this study are as follows:

Total length	= tip of snout to tip of tail.
Snout-vent	= tip of snout to posterior edge of anal flap.
Tail length	= posterior edge of anal flap to tip of tail.
Arm length	= pit of arm to tip of longest finger exclusive of claw.
Leg length	= insertion of leg with body to tip of longest toe, exclusive of claw.
Head length	= tip of snout to posterior edge of skull between occipital spines or at the base of interoccipital spine if present.
Head width	= width across the angles of the lower jaws.
Frontal width	= widest part of frontal area, exclusive of superciliary spines.
Eye-snout	= tip of snout to anterior edge of eyelid.
Eye-ear	= ventral extent of eyelid to dorsal edge of auricular opening.
Ear-snout	= tip of snout to anterior edge of one auricular opening.
Spine length	= tip of spine to base of spine.

Combinations of these measurements were computed as ratios and set up as indices by the sample formula, $\Sigma\left(\frac{\text{snout-vent}}{\text{total length}} \times 100\right) =$ average ratio in percentages where a series of specimens was avail-

able. The actual measurements of individuals are given in the species of which only a few specimens were available.

The nomenclature used in the descriptions is mainly that of Smith (1946, Handbook of Lizards). For characters or structures not named in Smith's book, I have applied the names which have general acceptance.

The abbreviations used in the locality data are as follows:

AMNH	American Museum of Natural History
USNM	United States National Museum
MVZ	Museum of Vertebrate Zoology, University of California.
LMK	Private collection of Dr. Laurence M. Klauber
SSNH	San Diego Society of Natural History
BYU	Brigham Young University
UU	University of Utah
NSM	Nebraska State Museum, University of Nebraska
KU	University of Kansas Museum of Natural History
EHT-HMS	Private collection of Dr. Edward H. Taylor
STANFORD	Leland Stanford Jr. University

The photographs, in the main, were made by the University of Kansas Photography Laboratory.

The maps portray only the general areas in which the species or subspecies might be expected to occur. Naturally the populations are continuous only in those areas favorable for *Phrynosoma*. The boundaries of the species are based upon the known distribution of the species and also on the geography of the adjacent areas.

ACKNOWLEDGMENTS.—It has been only through the generous loan of books, specimens, and information by a number of individuals and institutions that my study was completed. I thank Prof. Vasco M. Tanner for suggesting and helping me initiate the problem as well as for lending to me the collection at Brigham Young University; Prof. Alden H. Miller and Prof. Robert C. Stebbins at the Museum of Vertebrate Zoology, University of California, for their hospitality while I was there, as well as for the loan of part of the extensive collection in their charge; Dr. Laurence M. Klauber for the loan of his personal collection and that of the San Diego Society of Natural History; Miss Margaret Storey, Stanford University, for making available the collection there; Prof. Angus M. Woodbury of the University of Utah for the loan of the collection of that University; Dr. Doris M. Cochran at the United States National Museum for making available their large collection, for supplying a place to work and allowing me to use the library facilities while at the Museum; Mr. Charles M. Bogert of the American Museum of Natural History for making

the collection of that Museum available and for supplying a place to study while at the Museum; Dr. Hobart M. Smith for helpful suggestions on several critical points; Professors E. Raymond Hall, Robert W. Wilson and Worthie H. Horr for editorial assistance; my many other friends and colleagues at the University of Kansas for their assistance as well as their generous criticism; and lastly Dr. Edward H. Taylor under whose guidance and direction this study was done, for the use of his most complete herpetological library, his private collection, and for other assistance.

CLASSIFICATION OF THE GENUS *PHRYNOSOMA*

Class Reptilia Laurenti
Subclass Diapsida Osborn
Order Squamata Oppel
Suborder Sauria Macartney
Family Iguanidae Gray

Genus *Phrynosoma* Wiegmann

Lacerta (*part.*) Linnaeus, Systema Naturae, 12 ed. vol. 1, 1766, p. 365-366.
Cordylus (*part.*) Laurenti, Specimen Medicum, exhibens synopsin Reptilium . . ., 1868, p. 56.
Tapaja (*part.*) Oken, Lehrbuch der Naturgeschichte, dritter Theil, Zoologie zweite Abteilung, Fleischthiere, Jena, 16, 1816, p. 294.
Tapayia Gray, Ann. Philos., NS., vol. 26, 1825, p. 197.
Tapaya (*part.*) Fitzinger, Neue Classification der Reptilium. Wien., 1926, p. 17.
Phrynosoma Wiegmann, Isis von Oken, 1828, p. 367.
Batrachosoma Fitzinger, Systema Reptilium, 1843, p. 79.
Tropidogaster Fitzinger (*nec.* Duméril & Bibron) (*loc. cit.*)
Anota Hallowell, Proc. Acad. Nat. Sci. Philadelphia, 1852, p. 182.
Doliosaurus Girard, United States Exploring Expeditions of the years 1838, 1839, 1840, 1841, 1842 under the command of Charles Wilkes USN, vol. 20, 1858, Zoology, p. 407.

TAXONOMIC HISTORY

Linnaeus (1766) described from the work of Seba (1734) the species *Lacerta orbicularis.* In this description Linnaeus distinguishes an α and β form. The form α is based upon the reference "*Mus. Ad. Fr.* I. P. 44. Lacerta eadem," and "*Seb. Mus.* I. t. 109. f. 6., t. 83. f. 1, 2." The form β is based upon "*Seb. Mus.* I. p. 134. t. 83. f. 1, 2, Lacerta orbicularis spinosus; *Hern. Mex.* 327, 328, Lacertus orbicularis; *Raj.* quadr. 263, Lacertus orbiculatus."

Two years later Laurenti, (1768, p. 51) restricted the Linnaean name by referring Seba's plate 83, figs. 1, 2, to *Cordylus orbicularis,* while basing the name *Cordylus hispidus* on Seba's plate 109, fig. 6. Inasmuch as figs. 1 and 2 of pl. 83 in Seba are reproduced from Hernandez, libr. 9 C. 16, the proper restriction of Linnaeus' name

to the Mexican species commonly known as *Phrynosoma orbiculare* is assured.

There are three available names antedating the Wiegmannian name *Phrynosoma* that must be considered. The first is *Tapaja* (1816, p. 294, Index p. 1266, erroneously spelled *Tapaia* in the table of contents, p. 6). Oken used the name in a subgeneric sense, under the genus *Agama*. The trivial names referred to *Tapaja* are not used with that generic name but with *Agama*. The first species cited under *Tapaja* is *Agama orbicularis* (Linnaeus, presumably, although no author is cited). Other species mentioned are *Agama plica* and *Stellio helioscopus*. Oken's inconsistency in the usage of generic names and failure to cite the origin of trivial names is very confusing.

The next name in chronological order is *Tapayia* Gray (1825, p. 197). This subgenus was cited with the single species *Lacerta orbicularis* Linnaeus.

The third name, *Tapaya* Fitzinger (1826, p. 7) included three species: *T. orbicularis* Cuvier, *T. gemmata* Cuvier, and *T. deserti* Fitzinger.*

The generic name *Phrynosoma* was proposed by Wiegmann in his "Beytrage zur Amphibienkunde" in Isis von Oken 1828, p. 367. Four species are there considered, as belonging to the genus: "*P. orbiculare* [*L. orbiculare* Linnaeus], *P. bufonium*, Wieg. *P. gemmata* and *P. cornutum* [*Agama cornuta* Harlan]."

Wiegmann (1834, p. 52) defines the genus as follows:

"*Caput* breve, postice valde dilatatum spinarum validarum corona cinctum, irregulari-tetraëdrum, fronte plana, clypei ad instar supra orbitas adscendente.

"*Dentes* maxillares parvi, simplices, cylindrici, obtusi, conferti, aequales; primores 5. Palatum edentulum.

"*Aures* apertae, sub colli plicis absconditae, tympano altius detruso.

"*Lingua* crassa, apice incisula. *Nares* anticae.

"*Truncus* compactilis, ovalis, depressus, bufonius, superne squamis inaequalibus, minutis vestitus, aliisque maioribus, acutis, sparsis spinulosus, ad latera aculeorum serie fimbriatus.

"*Cauda* brevis, basi latissima, depressa, apice teretiuscula, squamis imbricatim vestita.

"*Membra* pro corporis mole breviuscula.

* The above was taken in part from Smith & Reeve, Herpetologica, vol. 7, pt. 2, 1951, pp. 53-55.

"*Glandularum* femoralium pori parum conspicui."

Wiegmann did not designate a type species.

Fitzinger (1843) divided the genus into three subgenera: *Phrynosoma* containing *P. orbiculare* Wieg. (Linnaeus) and *P. douglassii* Wiegmann (Bell); *Batrachosoma* with *P. coronatum blainvillii;* and *Tropidogaster* with *P. cornutum* Gray (Harlan), and *bufonium* Wiegmann (*P. cornutum* (Harlan)). In this same work (page 17) he designates *P. orbiculare* Wiegmann (Linnaeus), as the type species of Wiegmann's *Phrynosoma.* Girard (1858) revised this genus dividing it into four subgenera two of which (*Phrynosoma* and *Batrachosoma*) were taken directly from Fitzinger (*op. cit.*), and a third (*Tapaya*)† from Cuvier (1817) and a fourth (*Doliosaurus*) being new. Under *Phrynosoma* Wiegmann, he placed *P. cornutum* Gray (Harlan) and *P. regale* Girard = (*P. solare* Gray). Under *Batrachosoma* Fitzinger appeared *B. coronatum* Fitzinger = [*P. coronatum coronatum* Blainville (*part.*), *P. c. blainvillii* Gray (*part.*), *P. c. frontale* Van Denburgh (*part.*) and *P. solare* Gray (*part.*)]. In *Tapaya* Cuvier, he places *T. orbicularis* Cuvier = (*P. orbiculare orbiculare* Linnaeus), *T. hernandesi* Girard = (*P. douglassii hernandesi* Girard), *T. ornatissimum* Girard = (*P. d. ornatissimum* Girard), *T. brevirostris* Girard = (*P. d. brevirostre* Girard) and *T. douglassii* Girard = [*P. d. douglassii* (Bell) (*part.*) and *P. d. ornatum* Girard (*part.*)]. Girard (1858) had divided *P. douglassii* into two distinct species assigning the name *P. ornatum* to the second. Before publication of the work, however, he changed his mind, and retained them both in the former species with the comment that "two species may yet be confounded under this heading . . . , all specimens from the northwest coast are much smaller than those of the more southern region of Utah; but since this fact might still be regarded by some as bearing upon the climate, we have, so far, refrained from recording them as distinct species." However, the plates for the work had been completed and processed by this time, resulting in the figure of this form carrying the caption *P. ornatum.* In the text *P. ornatum* is in the synonymy of *P. douglassii.* In his fourth subgenus *Doliosaurus,* Girard placed *D. mc'calli* Girard = [*P. platyrhinos platyrhinos* Girard (*part.*) and *P. p. calidiarum* (Cope) (*part.*)], and *D. modestus* Girard = (*P. modestum* Girard). Girard supplied the name *Doliosaurus* instead of using *Anota.* His reason for not using the latter was that the name typified only one of the three genera he wished to

† Cuvier, Reg. Anim. vol. 2, 1817, p. 55, refers to the group as "les Tapayes" he does not use the term as a scientific name.

place under it, and not that it was preoccupied as indicated by Cope (1900). Aug. Duméril and Bocourt (1870) and Bocourt (1874) retain the Girardian subgenera *Phrynosoma, Tapaya,* and *Batrachosoma* substituting Hallowell's *Anota* for Girard's *Doliosaurus.* The arrangement of the species under these subgenera varies from that of Girard only in the case of *Anota* where only *A. mc'callii* Hallowell is included. Duméril and Bocourt place *modestum* and *platyrhinos* in the subgenus *Phrynosoma.*

Cope (1900) considered the group of species as two distinct genera: *Phrynosoma* and *Anota.* He defines the latter with the statement, "This genus only differs from *Phrynosoma* in the concealment of the tympanic drum by the integument, which is scaly." In this genus he placed five species (four according to his text): *A. modesta* Girard = (*P. modestum* Girard), *A. calidiarum* Cope = (*P. platyrhinos calidiarum* Cope), *A. goodei* Stejneger = (*P. platyrhinos goodei* Stejneger), *A. platyrhina* Girard = [*P. platyrhinos platyrhinos* Girard (*part.*) and *P. d. calidiarum* Cope (*part.*)] and *A. maccallii* Hallowell = (*P. m'callii* (Hallowell). The character used by Cope to define this genus was recognized by Girard (1858) to be of a variable nature in two of the three species he wished to place under it. This led to his usage of the subgeneric name *Doliosaurus* rather than *Anota.* Cope's arrangement was therefore not popularly followed. Bryant (1911) in working with the California species of the genus also placed *m'callii* in the genus *Anota,* based upon the apparent closure of the supratemporal fossae by bone. His observations, however, were based upon a single specimen and because of this, his arrangement was not generally followed. Van Denburgh (1922) recognized only *Phrynosoma* as did Smith (1946). I have here recognized only the genus *Phrynosoma.*

OSTEOLOGY

The descriptive osteology given here is based mainly upon the skeleton of the species *Phrynosoma cornutum.* Cope (1900), Bryant (1911) and Broom (1948) are drawn upon freely throughout the descriptions.

Premaxillary: The premaxillary bone is at the apex of the upper jaw. It is approximately one to one and one-half times as high as wide. Dorsally it forms a wedge between the paired nasal bones, which overlap it laterally. The premaxillary bone forms only a small part of the boundary of the nasal openings, articulating dorsally with the nasals and laterally with the maxillaries.

Nasals: The nasals flank the posterior part of the fused premaxillaries extending posteriorly and laterally where they meet the frontals and prefrontals. The nasals form the medial and most of the dorsal boundary of the nasal openings.

Prefrontals: The prefrontals are roughly crescent-shaped and lie laterally and posteriorly to the nasals. Anteriorly they complete the dorsal and lateral part of the boundary of the nasal opening articulating there with the nasals and the maxillaries. A lateral posterior projecting process forms the anterior half of the superciliary bar. Posteriorly the prefrontals articulate with the frontals.

Frontals: The frontal bones are fused into a single element, which is roughly T-shaped. The anterior part forms a wedge between the prefrontals and articulates with the nasals. The posterior border forms with the parietals a nearly straight transverse suture, which passes through the pineal foramen. The anterior and lateral projections of the frontal form the posterior half of the superciliary bar. The frontal and prefrontals form the entire boundary of the superciliary fossae.

Postorbital: The postorbital forms the posterior boundary of the orbit articulating dorsally with the frontal and parietal, and ventrally with the jugal and squamosal. The postorbital may bear several tubercles.

Parietals: The parietals are fused, forming the heavy posterior, medial border of the head where it supports two large lateral and one small medial occipital spines. The parietal articulates anteriorly with the frontals, laterally with the postorbital, squamosal, tabulare and opisthotic, and posteriorly with the supraoccipital, and prootic. Its surface is covered with numerous tubercles.

Squamosal: The squamosal bones form the posterior lateral angles of the skull articulating medially with the parietal, tabulare, quadrate, and opisthotic and laterally with the jugal and postorbital. It bears laterally three moderately large spines and forms with the postorbital and parietal the boundary of the supratemporal fossa.

Jugal: The jugal articulates posteriorly with the squamosal, dorsally with the postorbital and anteriorly with the maxillary. The jugal forms the central portion of the ventral border of the optic cavity. Medially it articulates with the ectopterygoid.

Paraoccipitals: The paraoccipitals furnish the lateral lobes of the occipital condyle, articulating ventrally with the basioccipital, laterally with the opisthotic, dorsally with the supraoccipital and anteriorly with the prootic.

Maxillary: The maxillary completes the bones of the lateral part of the skull. It articulates posteriorly with the jugal and anteriorly with the premaxillary. A dorsal projection meets the prefrontal at the dorsolateral corner of the nasal opening. The maxillary forms the ventral and lateral boundary of the nasal opening. Medially it articulates with the palatine.

Basioccipital: The basioccipital furnishes the central part of the tripartite condyle. It articulates dorsally with the paraoccipitals, and anteriorly with the basisphenoid.

Supraoccipital: The supraoccipital articulates ventrolaterally with the opisthotic, dorsally with the parietal, and forms the upper boundary of the foramen magnum.

Opisthotic: The opisthotic articulates medioventrally with the basioccipitals, laterally with the tabulare, quadrate and parietal, anteriorly with the prootic, and forms the lateral boundary of the foramen magnum.

Tabulare: The tabulare is a small thin bone, wedged between the opisthotic, squamosal, quadrate and the parietal.

Prootic: The prootic can be seen through the fossa formed by the opisthotic, supraoccipital and parietal. The prootic articulates dorsally with the parietal and ventrally wih the supraoccipital, paraoccipitals and opisthotic.

Quadrate: The quadrate bone is troughlike in appearance, and the hollow area is directed posteriorly. The bone articulates dorsally with the squamosal, tabulare, and parietal bones, extending ventrally and slightly anteriorly to form at its ventral end the articulating surface that receives the articulare of the lower jaw. Medially and toward the distal end the quadrate articulates with the pterygoid.

Basisphenoid: The basisphenoid forms a broad triangle if the pterygoid processes are omitted from consideration and articulates posteriorly with the basioccipital by means of a nearly straight suture and laterally with the pterygoid by means of the pterygoid process. An anterior membranous projection of the basisphenoid articulates with the medial edges of the palatines.

Pterygoid: The laterally compressed posterior part of the pterygoid articulates with the medial distal end of the quadrate. The central part articulates mesially with the basisphenoid, laterally with the ectopterygoid and dorsally with the epipterygoid. The anterior dorso-ventrally compressed part articulates anteriorly with the prevomer and medially by cartilage with the projecting spine of the basisphenoid.

Ectopterygoid: The ectopterygoid is a short bone extending from the mediolateral process of the pterygoid to the suture of the jugal and maxillary of the upper jaw.

Epipterygoid: The epipterygoid extends dorsally and posteriorly from the middle part of the pterygoid to the bottom of the prootic bone. The epipterygoid is characteristic in that it does not reach the parietal as is the case in other lizards.

Palatines: The palatines are without teeth and extend posteriorly from the pterygoids, which they overlap slightly, to the prevomers. The palatines articulate laterally with the maxillaries.

Prevomers: The prevomers articulate anteriorly with the premaxillaries, laterally with the ventral process of the prefrontals, and posteriorly with the palatines. The prevomers meet at their anterior extremities for a short distance but are separated for most of their length by a hiatus.

Stapes: The stapes is long and slender, extending from the capsul at the base of the opisthotic ventrolaterally to where it abuts against the tympanum. The stapes apparently does not receive additional support from the quadrate, as is the case in some other groups of lizards.

Dentary: The dentary comprises the anterior half of the lower jaw, and bears all of the incisorlike teeth. On the lateral surface it articulates posteriorly with the small dorsally located coronoid and the large surangulare. Medially the dentary is split about midway into two rami. The ventral ramus articulates first with the splenial and more posteriorly with the narrow angulare.

Surangulare: The surangulare makes up the posterior half of the lateral surface of the jaw, bearing on its ventrolateral margin from four to six protuberances that increase in size from front to back. The surangulare articulates on the anterolateral surface of the jaw with the dentary and coronoid, and on the posterolateral surface with the articulare and prearticulare. Ventrally the surangulare articulates with the dentary and the angulare and medially with the prearticulare and coronoid.

Articulare and Prearticulare: The articulare is fused with the prearticulare. They articulate laterally with the surangulare, ventrally with the angulare, and medially with the splenial and coronoid.

Angulare: The angulare is small and somewhat spindle-shaped, seen best from the ventromedial angle. The angulare is bordered medially by the prearticulare and the splenial and laterally by the dentary and the surangulare.

Splenial: The splenial bone is on the inner surface of the jaw forming, with the anterior projection of the coronoid, the wedge that fits between the two rami of the dentary. The splenial articulates anteriorly with the dentary and coronoid and posteriorly with the angulare and prearticulare.

Coronoid: The coronoid bone forms the dorsal projection or bump on the mandible and articulates laterally with the dentary and surangulare and medially with the dentary, splenial, prearticulare and the surangulare.

Vertebral column: The vertebral column consists of approximately 31 procoelous vertebrae, bearing ribs from the third to the twenty-second inclusive. The two sacral vertebrae are partly fused. The neural spines are short. The haemal arches are present on from six to eight caudal vertebrae, being rudimentary or vestigial on the remaining. The vertebrae lack the zygosphene articulation although corresponding rudimentary processes are present. Intercentra are present only in the cervical vertebrae.

Ribs: There are usually twenty pairs of ribs, of which the first pair and the last four or five pairs are short, the second to seventh articulating by cartilage with the sternal ribs.

Pectoral girdle: The sternum is large and about as wide as long. A large foramen pierces the posterior half. The front angle is acute, (55°-60°), with the sides grooved to receive the coronoid bones. The posteriorlateral margins are serrate, each point being the articulating surface for a sternal rib of which there are two in this species. The ziphoid processes articulate at the posterior angles of the sternum and join the cartilage of the eighth pair of ribs.

Interclavicles: At the anterior tips of the sternum are found the slightly curved laterally projecting interclavicles. The clavicles meet each other medially where they articulate with the anterior dorsal surface of the medial portion of the interclavicles. Distally the clavicles are in contact with the anterior edges of the scapula and suprascapula.

Coracoid: The coracoid is in broad contact with the sternum and projects anteriorly beneath the clavicle and interclavicle where, with a process from the scapula, it forms two separate foramina. The foramina may be open on the anterior edge in young specimen.

Scapula: The scapula is about equal in length to the coracoid, but is considerably narrower. The suprascapula is nearly twice as long as the scapula, curves posteriorly and lies upon the ribs.

Pelvic girdle: Ilia: The ilia are stout, extending obliquely dorso-

caudally. The inner side of the anterior dorsal border articulates with the pelvic ribs.

Pubes: The pubes are unevenly curved, and differ from the ilia in being lighter structurally and slightly longer.

Ischia: The ischia are intermediate in weight between the ilia and pubes and are longer than either. Both the pubes and ischia lie in the transverse plane and are connected medially by a thin cartilaginous rod. They form two large ischiopubic foramina. A cartilaginous rod projects posterodorsally from the median symphysis of the ischia.

Limbs: The limbs are typically lacertilian in structure.

FEEDING HABITS

Examination of the stomach contents of a number of these lizards shows the preferred food to be insects of which the greatest percentage is ants. The myrmecophagus diet is not surprising when it is realized that ants occur in abundance throughout the areas inhabited by the horned lizards. I doubt, however, that the absence of ants from an area would alone prohibit the occurrence of these lizards, if other ground living insects were present. In Utah, Knowlton and Jones (1934:10) and Knowlton and Thomas (1936:65), found by stomach examination that these lizards ate a variety of insects, including beetles, grasshoppers, weevils, and leafhoppers. I have successfully kept alive, in captivity, specimens of *P. d. ornatissimum* and *P. cornutum,* by feeding them crickets, blister beetles, woodborer larvae, centipedes, pill bugs, and meal worms. An unsuccessful attempt was made to condition them to eat hamburger or small pieces of beef.

An interesting observation was made by Van Denburgh (1922: 430) regarding the reaction of a colony of ants toward a preying horned lizard.

". . . [*P. m'callii*] was sitting on an ant hill, but not an ant was in sight although a half hour later they were swarming over it. It seemed as though the ants remained under cover in the nest as long as the lizard was watching them." I have several times observed individuals of *P. platyrhinos platyrhinos* on the runways leading to an ant hill that appeared to have normal ant activity including the runway past the lizard. I have placed several of these lizards upon different ant hills in an attempt to observe the phenomenon mentioned by Van Denburgh, but in all instances the lizards left the hills immediately, possibly from fright induced by

being handled. However, Winton (1917:8) observed that these lizards displayed extreme discomfort when stung externally by ants. Little and Keller (1937:216) recorded the death of a horned lizard caged over an ant hill and concluded that the lizard died from being stung by ants.

Movement of the food is necessary before these lizards will show any interest in it. The response toward moving objects seems to be in one of two directions and seems to be controlled by the size of the moving object. If the object is small, the response is one of feeding; if the object is large, the response is an attempt to protect itself or to escape. I have observed this repeatedly with captive horned lizards. Sometimes both responses can be observed in a single group of lizards when the food approaches the maximum edible size.

Feeding upon ants or other small insects is accomplished by an approach which may be from any angle, and a quick flip of the mucous-coated tongue to which the prey adheres. For larger forms the lizard maneuvers so that the attack is made usually on the anterolateral part to the prey; again the sudden flip of the tongue secures the prey, then the head is bent downward with the snout near the ground and this bending is accompanied simultaneously by a sideward movement which often brings the food in contact with the ground. This latter maneuver Bryant (1911:35) has suggested is a means of breaking up large prey. I would rather consider it an aid in the swallowing process which often takes a minute or more in cases involving large insects.

As with most cold-blooded vertebrates, optimum temperature is necessary for active feeding. Norris (1949), in studying the cloacal temperatures of the species *P. m'callii,* found that the extremes for the optimum cloacal temperature were divided by approximately 5°C; presumably the extremes were approximately 36°C and 41°C. Cowles and Bogert (1944), in a temperature study of some of these lizards, supply the following:

	Retreat from cold	active range	Max. voluntary tolerance
P.p.platyrhinos	29 0°C	36 8°C	39 6°C
P.m'callii	29 3°C	36 9°C	41 0°C
P.c.blainvillii	28 0°C	34 9°C	39 0°C

The lizards retreated under the sand at both the upper and lower extremes.

BREEDING HABITS

Both oviparous and ovoviviparous forms occur within this genus. The known oviparous forms include *P. cornutum*, *P. coronatum* (presumably all subspecies), *P. solare*, *P. platyrhinos* (all subspecies), and probably *P. m'callii*. The only species known for certain to be ovoviviparous is *P. douglassii* (presumably all subspecies).

Mating takes place in the spring generally during the months of April, May and June. The exact time is governed to some extent by the general weather conditions and more extensively by the geographic location of the species. Courtship displays and mating behavior have been observed in several cases. Wood (1936:177) presents the courting behavior of a male and female *Sceloporus occidentalis occidentalis* after which he states: "Several horned toads, *Phrynosoma b. blainvillii* (Gray), exhibited a similar behavior. The chief difference here was that the grip on the left side of the neck was firmer and the lizard, raising himself on his fore legs would jerk his head quickly to the right, at the same time pushing forward on all fours, thus turning the female over on her back." His report on *Sceloporus o. occidentalis* is here given:

". . . A large male was pursuing two adult females. He would grasp a female with his jaws, usually by the left side of the neck. Either immediately after grasping the female or after a short pause, he would very actively attempt to push her over on her back. Sometimes she tried to break away and the result was that the two ran about in circles. At other times she made no attempt to escape. Then he would roll her over on her back, all the while firmly retaining his grip on her neck. Sometimes he grasped her by the side of the body and tried to push her over but she would run forward trying to break away. Thus the two would travel about the cage in circles until the male released his hold. . . . Although the author saw this behavior many times, copulation was never observed."

Hewatt (1937:234) observed the behavior of a male and female of the species *P. cornutum*. His observations are as follows:

"Two specimens of *Phrynosoma cornutum* were collected from different localities on April 19, 1936. While they were being held in the writer's hand one of the lizards grasped the other by the loose skin back of the left fore leg and held on tenaciously. When

placed upon the ground the female tried to escape but was held firmly by the male. After the female had subsided, the male grasped her left horn and began to scratch the dorsal region back of the fore legs. Following this irritation the female lizard turned her posterior ventral surface to one side and the male placed his cloacal aperture over that of the female. The female was never on her back but was in a twisted position. With vigorous activity the male everted the copulatory organ and inserted it into the female's cloaca. A close examination revealed that the semen passes along a groove in the copulatory organ. The complete courting and copulation processes occupied sixteen minutes."

Milne (1938:200) observed a pair of copulating *P. cornutum* whose action was, with a few exceptions, mainly as described by Hewatt. The male's position was atop the female upon whom he rode, sometimes with his hind legs dragging on the ground. An interesting account of the "penis" was given by her as follows: "The penis, a very dark red structure covered by a moist mucous membrane, was exposed for fully 13 mm. between the male's cloacal orifice and where the penis curved under the left side of the female's tail to enter her cloacal orifice. The penis after removal (fully distended) measured 31 mm. long by 6 mm. broad by 4 mm. deep, tapering only in the apical third."

The oviparous forms generally lay their eggs shortly after mating. Deposition of the eggs of *P. cornutum* has been observed by Reese (1922), Cahn (1926) and Hewatt (1937). In general, they are all the same. The female excavates a slanting hole in the ground 4 to 6 inches deep and 3 to 4 inches in diameter. Into the hole she deposits her eggs in layers each covered by a small amount of dirt. Two or three layers are deposited depending upon the size of the clutch, which varies from 20 to 40 eggs in *P. cornutum,* 8 to 15 in *P. platyrhinos,* 25 to 28 in *P. solare* and 6 to 14 in *P. c. blainvillii.* The excavation is then completely filled with soil and left without further attention by the adults. Hatching occurs in 40 to 50 days in *P. cornutum* with a slightly longer period in *P. platyrhinos.* In *P. c. blainvillii* the eggs are evidently retained in the oviducts until a few hours before hatching. Bryant (1911:14) reports, "with *P. blainvillii* [*P. coronatum blainvillii*], however, the young hatch a few hours after the eggs are layed . . . , they vary in number from six to fourteen."

In the species *P. douglassii,* which is ovoviviparous, mating takes place in April and May with the young being born in July and August. The number of young is between 8 and 30. Smith, C. F.

(1941:114) records the birth proceedings of a specimen of *P. douglassii hernandesi* as follows:

"Ten of the young were born prior to 9:30 A. M., when the event was first called to the writer's attention. The remaining five arrived at 9:31, 9:42, 9:55, 10:30, 10:45, respectively. Three of the first ten were born between 9:00 and 9:30, but the exact time was not recorded.

"The mother assumed a position with body raised, not touching the ground, dropped the young, and moved off a few inches. She showed absolutely no interest in subsequent events. Birth was accompanied by the discharge of one or two drops of watery fluid.

"Each of the young was surrounded by a watery fluid that was enclosed in a thin, fragile, transparent membrane. In some cases the posterior end of the fetus emerged first, while in others, the opposite end emerged first, but the fetus was always dorsal side uppermost. The fetus was not curled within the membrane except that the tail was pressed tightly against the right side of the body.

"After birth, the fetus remained motionless for a period of time varying in these specimens from five to fifty-five minutes. The first motion was a wriggling one, and was continued, in some cases intermittently, until the egg membrane was broken. Then the lizard gasped for breath, swallowed a few times, and crawled off several steps to dry."

Upon the deposition of the eggs or the completion of parturition, the female's duty is finished and genenrally she shows no interest in the young. However, Lockwood (1883:682) reported observing a *P. cornutum* (probably *P. douglassii brevirostre*) from South Platte Canyon that appeared to show maternal "anxiety" for her young by keeping herself between them and the observer while directing the young into a small depression. Following this she ran across the path of the observer, which he interpreted as an attempt to attract attention away from the, then concealed, young. This is the only known case where this action of these lizards has been interpreted as parental care of the young.

DEFENSIVE HABITS

The rough horny appearance of these lizards would seem to be enough warning to would-be predators without additional defensive displays and mechanisms. A few snakes, however, seem to disregard both appearance and displays only to find themselves victims instead of victors. Cope (1900:404) reports finding a dead snake with the occipital horns of a specimen of *P. cornutum* pro-

truding from the sides of the neck. Vorhies (1948:303) writes that:

"Some 15 years ago there was brought to me a recently born *C. atrox* that had attempted to swallow a horned lizard, *Phrynosoma solare*. It engulfed the head of the lizard, but the horns of the prey penetrated the wall of the neck region of the rattlesnake, so that both predator and prey were locked together and perished in that position."

Bryant (1911:15) lists the rattlesnake *Crotalus* and the roadrunner *Geococcyx californicus* as the two natural enemies of the horned lizard. Miller (1948:67) adds also the prairie falcon *Falco mexicanus* as a possible predator. He presents the following:

"During a lifetime acquaintance with the horned lizards in California, I have never until the past year observed a case of one having fallen victim to a predator. On May 8, 1946, I prepared a freshly taken specimen of the prairie falcon (*Falco mexicanus*) from the desert 30 miles east of Indio, California. In its stomach were the hind feet and the terminal half of the tail of a horned lizard neatly snipped off. In addition there were small fragments of reptile bone that I could not identify with certainty, but have no reason to doubt belonged to the same individual. Mr. Gerhard Bakker, of Los Angeles City College, determined the species as *Phrynosoma platyrhinos* which is the form one would expect from that area."

The rough irregular appearance, of these lizards, and their ability to adapt the basic body colors to fit those of the substrata, permits these lizards to escape the notice of many observers. Their adaptation for burrowing and remaining beneath the sand probably has helped many to escape or be passed by unnoticed.

In several instances they have been observed to defend themselves actively against the advances of a supposed enemy. Cope (1900:411) includes in his discussion of the species *P. douglassii* the following observations made by Dr. Elliott Coues:

". . ., a certain slight means of defense which the 'horns' may sometimes afford is shown by the use they are put to when the animal is irritated by poking with a finger or bit of a stick; then the head is lowered, the horns set forward, the back arched up, and the whole attitude becomes ludicrously like that of a bull in miniature. The horned lizards show special aversion to dogs. On approach of one they raise themselves to the full length of the legs, puff out the body, open the mouth, and hiss audibly, altogether presenting quite a formidable front."

Ditmars (1936:67) described the action of the rare *P. ditmarsi* as follows:

"When annoyed it would arch its back, point its snout downward, then make jumps of fully an inch from the ground, each jump accompanied by a miniature hiss which sounded like a sneeze."

Such displays are not uncommon to those familiar with these lizards. During the winter of 1949-50, captive specimens of both *P. cornutum* and *P. douglassii ornatissimum* were induced to display repeatedly by tormenting them with a moving object such as a finger or a pencil.

The well-publicized blood-squirting from the eyes of certain of these lizards is generally interpreted as a defensive mechanism. Just how the phenomenon repels the enemy is not known. Tests of the blood have failed to show the presence of toxic substances, however, dogs seem to show a great aversion to the lizards after the blood has been released. The blood squirting was first thought to be associated with ecdysis, but repeated reports of ejections by lizards in all stages of the molting cycle seem to disprove this. A histological study and analysis of the tissues following the squirting is presented by Bruner (1907) and Burleson (1942). Discrepancies in the two reports indicate that the process is not as yet well understood.

EVALUATION OF TAXONOMIC CHARACTERS

Since the criteria for speciation in the genus *Phrynosoma* are based primarily upon morphological differences and secondarily upon coloration, it seems wise to define and evaluate the characters most commonly used in the descriptions and diagnoses of these lizards before discussing the origins and relationships of the species. The names used by the earlier workers for any given character, varied, and may lead to erroneous conclusions by subsequent workers.

The distinguishing characters can be divided into three general groupings of: squamation, body proportions, and color and color pattern, under which they will be briefly discussed.

SQUAMATION

Occipital spines: These spines are on the posterior mesial border of the skull. Normally there are two spines present and often there is a short interoccipital spine between them. These spines are reduced in some forms and are entirely missing in *P. ditmarsi.* On the other hand there are four, long, closely set occipital spines in

P. solare. The characters of the occipital spines are of value in the general specific diagnosis as indicated above and likewise in determining the subspeciation in *P. douglassii* and *P. orbiculare* where the proportionate length of the occipital spines to the temporal spines serve as the chief diagnostic characteristic.

Temporal spines: Projecting from the laterally expanded temporal area of the skull, there are normally three pair of temporal spines. However, the range within the genus from complete absence in *P. ditmarsi* to five pairs in *P. platyrhinos* and *P. coronatum.* The spines are of particular importance in distinguishing the subspecies of the species *P. orbiculare, P. douglassii, P. platyrhinos* and *P. coronatum.*

Frontal scales: Unlike many of the lizards that have large, regular, platelike scales on the frontal area of the head, *Phrynosoma* has reduced, irregularly-shaped scales. The texture, size and coloration of these scales are of taxonomic significance, especially in the subspecies of *P. coronatum.*

Superciliary ridge and spine: Extending longitudinally above the eye, and forming the lateral border of the frontal area, the superciliary ridge terminates posteriorly in a superciliary spine. The ridge itself is of little use as a diagnostic character. The size and shape of the spine is distinctive in *P. asio,* but is of little use elsewhere in the genus because of its variability. Attempts to use it in a comparative manner with the postlabials, occipitals or temporals proved unprofitable.

Supralabials and infralabials: The labial series, exclusive of the sublabials, is nearly uniform in both number and character throughout the genus with approximately the same variations occurring in all forms.

Sublabials: The sublabial scales are the small scales separating the infralabials from the chinshields. Depending on the species, arrangement varies from one in which the infralabials and chinshields are in contact, with no sublabials present, to a condition in which they are separated by six or seven rows of sublabials. They are of use in indicating likenesses and differences between the species and provide a useful means for differentiating *P. ditmarsi.* The number of sublabial rows present is directly correlated with the depth of the lower jaw both of which features are dependent upon the size and erectness of the quadrate bone.

Chinshields: The chinshields are on the ventrolateral edge of

the mandible and are of particular importance in the diagnoses of the subspecies of *P. coronatum*.

Postrictal scale: Present in only part of the species, the postrictal scale is a long conical scale at the anteroventral corner of the auricular opening. It is present in some subspecies of *P. coronatum* and absent in others.

Subrictal scale: Also limited to certain species, the flattened subrictal is found between the last chinshield and the postrical scale. Its position is of importance in the diagnoses of the subspecies of *P. coronatum*.

Gular scales: The scales on the throat between the rows of chinshields, from the tip of the jaw posteriorly to the transverse gular fold are collectively called the gular scales. They may be subequal throughout, or there may be one longitudinal row or more of enlarged scales on each side. Three or more enlarged rows are characteristic of *P. asio* and *P. coronatum*. The gular scales are characteristically mildly keeled in *P. boucardii*.

Tympanum: Defined as the membrane across the ear opening, the tympanum in some forms has a tendency to be covered by scales. This is consistently true in only one species (*P. m'callii*) although it occurs in certain populations of other species. Not to be confused with the above covering is the lateral fold of skin, which in some horned lizards conceals the entire auricular opening. The covering by folds of skin is itself a character in several of the groups.

Dorsal body scales: The dorsal scales covering the back from the neck to the base of the tail between the lateral abdominal fringes vary considerably in size and texture on a single specimen of the horned lizards. The general basic covering is of small imbricate scales, among which are several sizes of larger scales; the largest generally form a series of longitudinal rows down the back. The abundance and size of the enlarged scales determines the apparent roughness that is used in a general grouping of the species and in several cases as a minor specific character.

Lateral abdominal spines: One or two lateral abdominal series of soft spines is found in all but one of the species of *Phrynosoma*. The number of lateral series serves to group the species. However, I do not regard such groupings as having a great degree of phylogenetic significance.

Ventral scales: The most significant diagnostic character occurring in the ventral scales is the presence or absence of keeling. The number of transverse or longitudinal rows has been recorded in a

few cases. I have concluded that, owing to the great variation in a single form, the number of rows does not serve as a distinguishing feature.

BODY PROPORTIONS

Head: The proportions of the head vary markedly in the genus. The length of the head measured from the notch between the occipital spines (from base of the interoccipital spine, if present) may be longer than, equal to, or less than the width of the head measured at the angle of the jaw. The ratio of the two measurements has been applied particularly in the diagnosis of the subspecies of *P. coronatum* as well as generally throughout the genus. The degree of bluntness or prolongation of the nose as reflected by the rostro-frontal angle is of use in grouping the species in a general way. Of limited use also are the ratios of such measurements as: eye-snout to head length; ear-snout to head length; frontal-width to head width and the occipital spine length to head length. The general contour of the head and frontal area however, are diagnostic in several species (*P. taurus, P. asio* and *P. douglassii*).

Body proportions: The general proportions of the body are quite similar throughout the genus. Width to length ratios were found to be diagnostic of sex but of little consequence in defining species.

Appendage proportions: Ratios of arm length to leg length or the ratio or either to the total length were found to reflect age and sex differences but to be of little or no use in differentiating subspecies or species. On the other hand, the ratios of the tail length to the total length, to the snout-vent length or to the head length, while also varying with age and sex, was found to be diagnostic of several short-tailed species and subspecies, (*P. braconnieri, P. taurus* and *P. douglassii brachycercum*).

Nostril position: The opening of the nostril with relation to the canthal line will divide the genus into several groups that are otherwise not necessarily closely related. The character is used in the key to help in differentiating several forms.

Femoral pores: The femoral pores are arranged in a row along the ventral surface of the thigh. The pores are generally more conspicuous in the males than the females. This is especially true during the breeding season when the pores of the male are functioning. The number of pores in the row, the location of the pore, whether in a single scale or surrounded by several scales, the number of preanal scales separating the rows and the single versus double row mesially, are significant in many forms. The double row is the only one used as a major character; it characterizes

P. orbiculare. However, the number of scales in each row and the number of preanal scales separating the row are usable as minor characters.

Color and Color Pattern

Head color and color pattern: The basic ground color of the head is generally the same as the ground color or the dorsal area of the body with markings on certain areas forming the color pattern. Color patterns of the head have been used in differentiating the subspecies of *P. coronatum* and also those of *P. douglassii.*

Dorsal color of body and color pattern: These lizards are able to change their color to correspond to that of the substratum upon which they live; thus color alone is an unstable character for differentiating one kind of horned lizard from another. However, the color pattern is generally quite constant and is of importance as a diagnostic character. Color pattern has not been greatly stressed in this study, except in the species *P. douglassii.* Elsewhere other characters were considered to be more reliable and were more easily used.

OSTEOLOGICAL CHARACTERS

In the past, osteological material in this genus has been used, to my knowledge, only on two occasions to provide characters of taxonomic worth. Cope (1900) described the skeletons of *P. douglassii, P. cornutum* and *P. coronatum;* and Bryant (1911) described and compared some of the skeletal elements of the California species. I have had available in this study, skeletons of eight of the fourteen species. In the main, most have been represented by a single specimen. Consequently I have hesitated to use each of several observable differences. Nevertheless, several features seem to be of specific rank. The size, position and erectness of the quadrate bone previously mentioned varies considerably; probably it is largest and most erect in the skull of *P. ditmarsi.* It is slightly smaller in *P. douglassii* and is progressively shorter and more horizontal in *P. cornutum, P. coronatum, P. platyrhinos* and *P. m'callii.* The bone is shortest in *P. solare* where it lies completely horizontal, paralleling the longitudinal axis of the skull. The size and shape of the temporal fossa (figs. 1-8) varies considerably; it seems to be completely closed in *P. m'callii.* The number of teeth on the premaxillary (table 1) as well as the total number of teeth on both the upper and lower jaws seems to be significant in showing relationships. Other characters will undoubtedly prove valuable when a more thorough study of them can be made upon a series of specimens.

SPECIES GROUPINGS

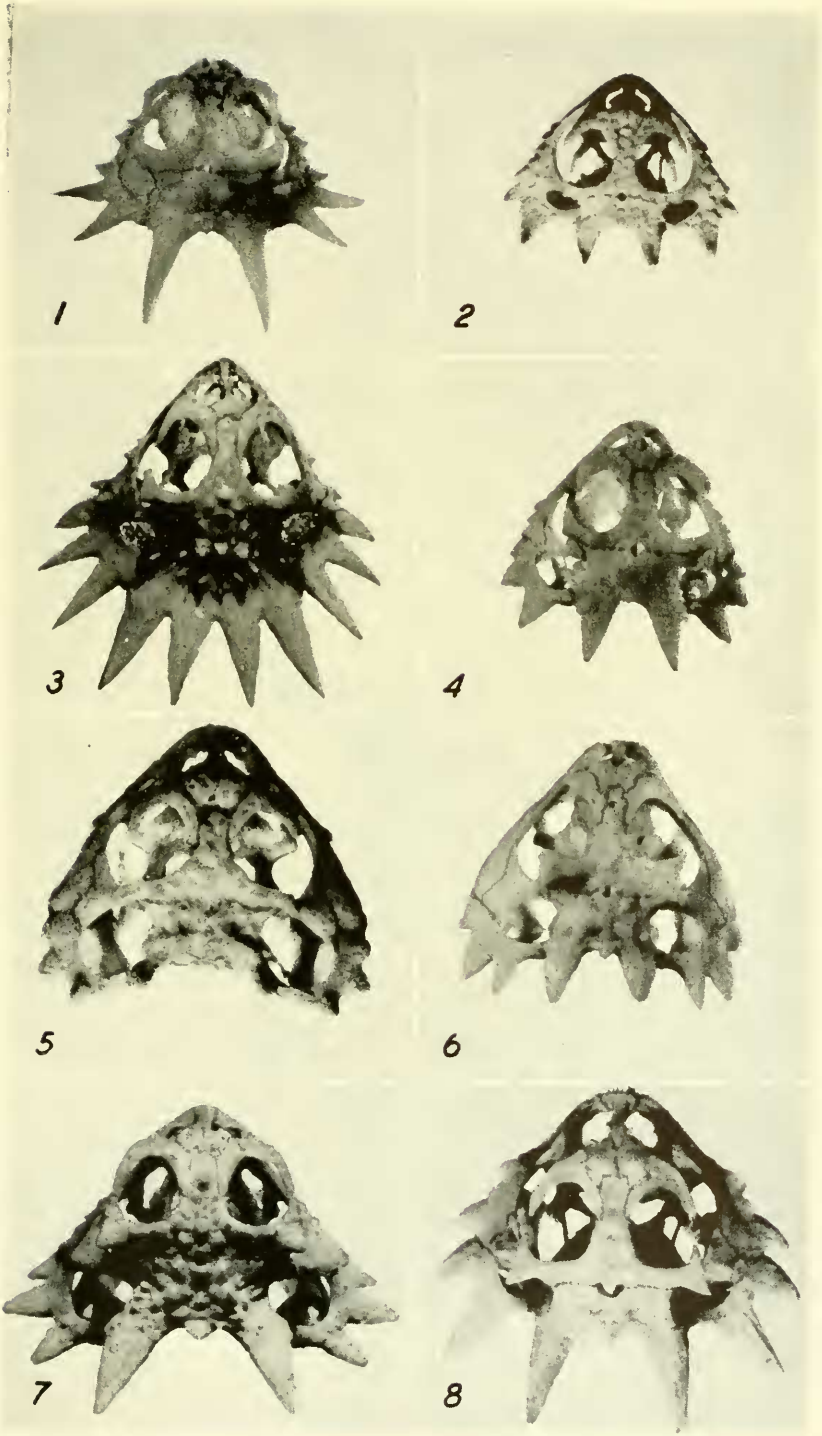
Based upon morphological characters, the genus *Phrynosoma* is found to contain fourteen species, four of which are broken into seventeen subspecies. The fourteen species fall naturally into eight groups of which the *orbiculare* group containing eleven forms, four species and nine subspecies, is the largest. The species and subspecies are as follows:

SPECIES GROUPS

Group	Species	Subspecies
braconnieri	*braconnieri*	
platyrhinos	*platyrhinos*	*platyrhinos*, *calidiarum*, *goodei*
	m'callii	
	modestum	
coronatum	*coronatum*	*blainvillii*, *coronatum*, *frontale*, *jamesi*, *schmidti*
	cerroense	
asio	*asio*	
cornutum	*cornutum*	
solare	*solare*	
taurus	*taurus*	
orbiculare	*douglassii*	*brevirostre*, *brachycercum*, *douglassii*, *hernandesi*, *ornatissimum*, *ornatum*
	orbiculare	*cortezii*, *dugesii*, *orbiculare*
	ditmarsi	
	boucardii	

FIGURES 1 to 8. Dorsal views of skulls of eight forms of horned lizards to show variation in the general skull structure. Magnification approximately × 1½.

1. *Phrynosoma m'callii*, KU 21931, Yuma, Yuma Co., Arizona.
2. *Phrynosoma modestum*, KU 473, Magdalina, Socorro Co., New Mexico.
3. *Phrynosoma solare*, EHT-HMS 10441, Santa Ana, N of Guaymas, Sonora, Mexico.
4. *Phrynosoma platyrhinos*, KU 22237, 1-15 mi. S Houserock, Coconino Co., Arizona.
5. *Phrynosoma douglassii ornatissimum*, KU 13943, 3 mi. SW Santa Fe, Santa Fe Co., New Mexico.
6. *Phrynosoma orbiculare cortezii*, KU 25858, Las Vigas, Veracruz, Mexico.
7. *Phrynosoma cornutum*, KU 19544, Devils River Auto Camp, Val Verde Co., Texas.
8. *Phrynosoma coronatum blainvillii*, KU 2730, Los Angeles, Los Angeles Co., California.


1
2
3
4
5
6
7
8

Certain characters common to both the asio and coronatum groups would seem to indicate relationship close enough that they might be included in the same group. However, the distribution of the species involved is such that they appear not to be closely related unless there was a connection between the distal end of Baja California and the mainland of Mexico. Such a connection seems to have little basis geologically or otherwise. The similarities in animals from the two places must, therefore, be considered as independent developments.

PHYLOGENY

In searching for an ancestral form for the genus *Phrynosoma*, paleontology is of little help. Two fossil records are available at this time. One from the late Pleistocene of Arkansas that, according to Gilmore (1928), is indistinguishable from the living forms, and a second from the middle Oligocene of Colorado that has been suggested by Gilmore (1928 & 1941) and Smith (1946) as a possible ancestral form. The latter was described by Cope (1873) as *Exostinus serratus*.

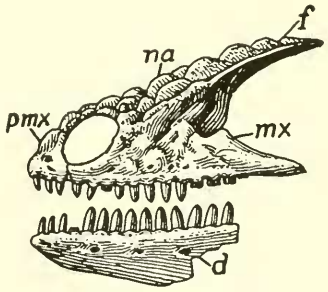


FIG. 1. *Exostinus serratus* Cope, USNM 16565; d, dentary; f, prefrontal; mx, maxillary; na, nasal, pmx, premaxillary. About three and one-half times natural size. (Reproduced from Gilmore, Proc. U. S. Nat. Mus., vol. 91, 1941, p. 75, fig. 32.

From the figure in Gilmore (1941) (reproduced here in figure 1), *Exostinus* would appear to be a lizard somewhat larger than *asio*, the largest living species of *Phrynosoma*. The tubercles of the frontals, nasals, maxillaries and dentaries would certainly seem

comparable with those of *Phrynosoma,* as would the structure and number of teeth. The crucial characteristics of the occipital region of the skull, unfortunately, are not known in the fossil genus.

Based upon the characters of the various living forms, I think that the common ancestral form was of medium to large size, dorsoventrally flattened, bearing medium to small-sized head spines of which there were probably two major occipital and five temporal

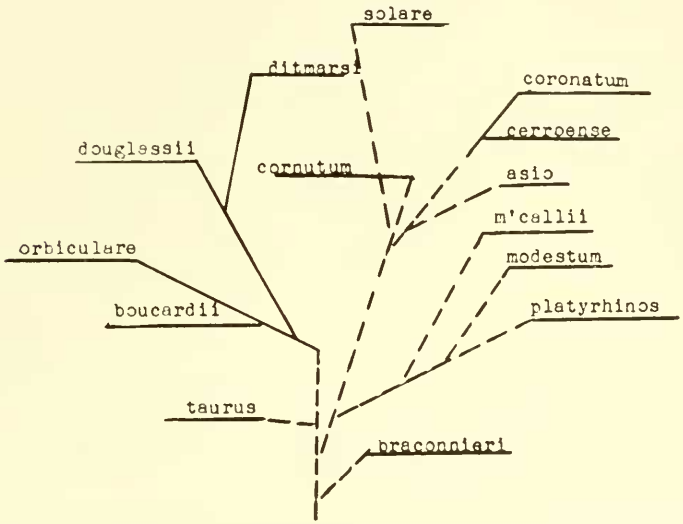


FIG. 2. Phylogenetic tree of the species of *Phrynosoma.* Broken lines indicate probable relationship, solid lines indicate reasonably sure relationship.

spines. The dorsal scales were unequal, the largest being of medium size and not excessively numerous. The tail was of medium length, possibly one half of the snout-vent length. The ventral scales were possibly smooth.

The following figure (fig. 2) expresses the probable relationships of the species in the genus:

SPECIATION

Primitive forms: I regard the species *braconnieri, taurus* and *platyrhinos* as the oldest members in the genus. The first two are monotypic; the latter has three subspecies of which *platyrhinos* shows the most primitive characters.

The most actively differentiating species are found in the or-

biculare, coronatum and platyrhinos groups. Of these, the orbiculare group contains eleven forms—four species, two monotypic —that are contiguous over a large area and I consider it to be the most recently evolved group. Both the coronatum group and the platyrhinos group are thought to have had a secondary dispersal.

Origin: The region consisting of the southern portions of New Mexico, and Arizona, southeastern California and adjoining parts of northern Mexico, probably was the center of origin of the genus. This is supported faunistically by the occurrence of *P. ditmarsi* and *P. solare*, the two most specialized forms, in this region while *P. taurus* and *P. braconnieri*, showing many primitive characters, occur at the periphery of the region occupied by the genus. The platyrhinos group has secondarily invaded the original area as will be seen below. Additional support for such a tenent is forthcoming from geologists which report saline deposits in the area as old as the Miocene epoch. This would seem to indicate the existence of arid conditions which were undoubtedly necessary in the evolution of the genus.

Distribution: The dispersal from the center of origin appears to be divisible into three general movements or waves. The first general movement involved the taurus and braconnieri groups that spread southward deep into Mexico, and the platyrhinos group of which *P. m'callii* moved slightly to the west; *P. modestum* spread to the east and northeast and *P. platyrhinos* spread to the north. A secondary movement of the species *P. platyrhinos* has occurred more recently; it moved southward and reinvaded the original center of dispersal. The second wave dispersed the solare, the cornutum, the asio and the coronatum groups. The solare group remained in the central area, the cornutum group moved east and northeast, the asio group moved south, and the coronatum group moved west. The latter group has more recently differentiated into several forms as it moved into Baja California. The third wave involved only the orbiculare group of which the species *P. orbiculare* and *P. boucardii* have dispersed to the south; *P. douglassii* moved mainly to the north and *P. ditmarsi* remained in the area of the original center of dispersal. The lateness, that is to say recency of the latter wave is indicated by the continuity of the group involved as a whole and by the relatively slight differentiation of the species and subspecies from one another.

Biotic Provinces

The adaptation of horned lizards to a more or less restricted semiarid terrestrial habitat, the small number of species, and the scarcity of specimens of some named forms render these lizards less useful than they otherwise would be as indicators of biotic provinces. Nevertheless, there is a close correlation between the boundaries of species and subspecies of the horned lizards of Mexico and the boundaries of the biotic provinces of that country as drawn by Smith (1939 & 1940). The species and subspecies that are within a single province in the Nearctic Region of Mexico are: *P. braconnieri* (Oaxacan Highland), *P. taurus* (Upper Balsan), *P. m'callii* (Arizonian), *P. platyrhinos goodei* (Arizonian), *P. orbiculare cortezii* (Hidalgan) and *P. coronatum coronatum* (Cape). The distribution of *P. douglassii hernandesi* in Mexico follows, in general, the combined provinces of the Apachian and Durangan provinces extending only slightly into the Chihuahuan. The subspecies *P. orbiculare orbiculare* is confined to the combined area of the Chihuahuan and Tamaulipan provinces. Farther west, *solare* occupies parts of the Apachian, Arizonian and extends slightly into the Sinaloan province.

Two representatives of the genus are found to occur in the Neotropical Region of Mexico. The species *P. asio* ranges from Michoacán on the north to Guatemala on the south, including or transecting the Lower Balsan, the Guerreran (Nearctic), the Oaxacan, Tehuantepecan, Tapachulan and possibly the Chiapan Plateau provinces. The second form, *P. orbiculare dugesii,* is found only in the Lower Balsan Province.

In the United States the geographic ranges of the several species of horned lizards do not coincide with the provinces proposed by Dice (1943). The known distribution of almost any given horned lizard extended over all, or parts, of two or more of Dice's provinces. In only one instance was there a boundary common both to a province and to the range of a horned lizard; that was the line dividing the subspecies *P. p. platyrhinos* from *P. p. calidiarum.*

In analyzing the distribution of the horned lizards of Baja California, their distribution seems to fit best the "Differentiation centers" described by Grinnell (1928). The subspecies with their corresponding "centers" are *P. c. blainvillii* (San Diegan), *P. c. schmidti* (San Pedro Mártir and San Benito Island), *P. c. jamesi* (San Ignacio), *P. c. coronatum* (Cape) and *P. cerroense* (Cedros Island).

TYPE SPECIMENS

The importance of type specimens in taxonomy is well known to those interested in this field. It is to these specimens that we must return to supply the inadequacies of the type description. In many instances types were not designated by the author of the name, thus requiring subsequent workers to attempt, usually by a process of elimination, to determine the specimen or specimens used for the type description. This has been the case in several forms of the genus *Phrynosoma.*

Following are the type specimens that I have examined in this study:

Phrynosoma asio (Cope), United States National Museum No. 32216.

Phrynosoma cerroense Stejneger, United States National Museum No. 11977.

Phrynosoma coronatum frontale Van Denburgh, Stanford No. 93.

Phrynosoma jamesi Schmidt, American Museum of Natural History No. 20583 (paratype only).

Phrynosoma ditmarsi Stejneger, United States National Museum No. 36022.

Phrynosoma douglassii brachycercum Smith, United States National Museum No. 23993.

Phrynosoma douglassii brevirostre (Girard), United States National Museum No. 208.

Phrynosoma douglassii hernandesi (Girard), United States National Museum No. 198.

Phrynosoma douglassii ornatissimum (Girard), United States National Museum No. 204.

Phrynosoma douglassii pygmae Yarrow, United States National Museum No. 11473.

Phrynosoma modestum Girard, United States National Museum Nos. 163 & 164 (nine cotypes).

Phrynosoma nelsoni Schmidt, United States National Museum No. 37585.

Phrynosoma platyrhinos goodei Stejneger, United States National Museum No. 8567a.

Phrynosoma platyrhinos platyrhinos Girard, United States National Museum Nos. 189 (three cotypes).

Phrynosoma platyrhinos calidiarum (Cope), United States National Museum No. 8444.

Phrynosoma regale Girard, United States National Museum No. 161.

Type specimens of the following species and subspecies were not examined in this study:

Phrynosoma boucardii Aug. Duméril & Bocourt, Museum d'Histoire Naturelle, Paris (two males and two females).

Phrynosoma braconnieri Aug. Duméril & Bocourt, Museum d'Histoire Naturelle, Paris.

Phrynosoma brevicornis Boulenger, British Museum of Natural History, London (two cotypes).

Phrynosoma bufonium Wiegmann, Zoologischen Museum, Berlin.

Phrynosoma cornutum (Harlan), type unknown.

Phrynosoma coronatum blainvillii Gray, British Museum of Natural History, London.

Phrynosoma coronatum coronatum (Blainville), Museum d'Histoire Naturelle, Paris.

Phrynosoma douglassii douglassii (Bell), British Museum of Natural History, London.

Phrynosoma douglassii ornatum Girard, type unknown.

Phrynosoma dugesii Aug. Duméril & Bocourt, Museum d'Histoire Naturelle, Paris. (Two cotypes.)

Phrynosoma harlanii Wiegmann, substitute name for *Agama cornuta* Harlan.

Phrynosoma m'callii (Hallowell), Academy of Natural Science, Philadelphia.

Phrynosoma ochoterenai Cuesta Terron, Type was formerly in Museo National, México, now missing.

Phrynosoma orbiculare cortezii (Aug. Duméril & Bocourt), Museum d'Histoire Naturelle, Paris.

Phrynosoma orbiculare orbiculare (Linnaeus), type is presumably an unnumbered figure in Hernandez Plantas Animales de Nueva España . . . , 1615, p. 327.

Phrynosoma planiceps Hallowell, type unknown.

Phrynosoma solare Gray, British Museum of Natural History, London.

Phrynosoma spinimentum Peters, Zoologischen Museum, Berlin.

Phrynosoma taurus Dugès, Museum d'Histoire Naturelle, Paris, (two cotypes).

Phrynosoma Wiegmanni Gray, British Museum of Natural History, London.

Tapaya orbicularis longicaudatus Dugès, Alfredo Dugès Museum, Guanajuato, Mexico.

KEY TO THE SPECIES AND SUBSPECIES OF PHRYNOSOMA

1. Four large occipital spines on posterior periphery of the head continuous with the temporal spines to form a continuous crown. Southern Arizona and Northern Sonora ..... *solare*
1′ Two occipital spines or occipital spines absent or reduced and not continuous with the temporal spines 2
2. Occipital and temporal spines absent; replaced by low rounded protuberances; lower jaw greatly expanded vertically; five or six small sublabials separating chinshields and infralabials ..... *ditmarsi*
2′ Two occipital spines present; lower jaw less expanded; sublabials five or less 3
3. Ventral abdominal scales keeled 4
3′ Ventral abdominal scales smooth 7
4. Temporal area prolonged, terminating in a large spine three or more times the length of the occipital spines ..... *taurus*
4′ Temporal area not prolonged, less than three times the length of the occipital spines; temporal spines same size as, or smaller than occipitals 5
5. Tail reduced (usually shorter than head); Puebla and Oaxaca, Mexico ..... *braconnieri*
5′ Tail not reduced (usually two to three times the length of the head) 6
6. Superciliary spines well developed, equaling, or nearly equaling, the occipital spines; ventral abdominal scales large, 30-40 across widest part of belly; three or four rows of enlarged scales on each side of gular area; one row enlarged soft spines in lateral abdominal fringe. Colima to Guatemala ..... *asio*
6′ Superciliary spines reduced, smaller than occipital spines; ventral abdominal scales small, 50-60 across widest part of belly; one row of enlarged gular scales on each side; two rows of soft spines in lateral abdominal fringe. Kansas, south and southwest through Oklahoma, Texas, New Mexico and northeastern Mexico ..... *cornutum*
7. Three or more rows of enlarged scales on each side of gular area; chinshields serrate and visible from above ..... coronatum group 8
7′ One or no row of enlarged scales, on each side of gular area, chinshields not serrate, not visible from above or if visible only the most posterior ones showing 13
8. Frontal scales large, flat, platelike, dark brown or black with distinct light narrow spaces between them; postrictal scales small or absent; subrictal scales usually in line with chinshields but sometimes slightly above 9
8′ Frontal scales small, convex, rugose (or if large convex and smooth and color the same as remaining portion of head); postrictal scale large; subrictal scale always distinctly above row of chinshields 11
9. Postrictal scale absent or small; subrictal in direct line with chinshields. Cape area of Baja California ..... *coronatum coronatum*

9′ Postrictal scale present and large; subrictal in line or slightly above row of chinshields 10
10. Chinshields four on each side; subrictal in line with chinshields; four temporal spines on each side. Cedros Island ..... *cerroense*
10′ Chinshields five on each side; subrictal slightly above row of chinshields; five temporal spines on each side. Between lat. 26°20′ and 28°40′ Baja California ..... *coronatum jamesi*
11. Frontal scales large, convex, smooth. Southern California and the northwestern part of Baja California ..... *coronatum blainvillii*
11′ Frontal scales small, convex, rugose 12
12. Head as wide as long or slightly wider than long; temporal spines curving posteriorly. Central to southern California, *coronatum frontale*
12′ Head slightly longer than wide; temporal spines projecting laterally, appearing serrate. Between lat. 28°50′ to near 31°50′ Baja California ..... *coronatum schmidti*
13. Length of occipital spines three or four times their basal diameter, 14
13′ Length of occipital spines less than two and one-half times their basal diameter 17
14. Two rows of soft spines in lateral abdominal fringe; tail markedly flattened; dark middorsal streak; ventral abdominal scales immaculate white. Southeastern California, southwestern Arizona and northeastern Baja California ..... *m'callii*
14′ One row of soft spines in lateral abdominal fringe; tail rounded or only slightly flattened; dark mid-dorsal streak absent; dark flecks usually present on the ventral abdominal scales 15
15. Three long temporal spines; occipital spines tend to curve laterally; usually only the last three chinshields greatly enlarged. Southern Arizona and northwestern Sonora ..... *platyrhinos goodei*
15′ Five medium sized temporal spines; occipital spines usually straight; chinshields enlarging gradually from first to last 16
16. Occipital spines long (48-60% of length of head) and broad, giving them a heavy appearance; tail often slightly flattened posteriorly. Southern Utah, Arizona, southern Nevada, California into northeastern Baja California ..... *platyrhinos calidiarum*
16′ Occipital spines short (45% or less length of head); tail rounded posteriorly. From Washington to southern Utah and southern Nevada ..... *platyrhinos platyrhinos*
17. No lateral abdominal fringes; gular scales subequal. Southern Texas, New Mexico and northern Mexico ..... *modestum*
17′ One row of soft spines in lateral abdominal fringe; one row of slightly enlarged gular scales usually present on each side 18
18. Head not strongly notched in occipital area; occipital spines one and one-half to two times as long as their basal diameter 19
18′ Head distinctly notched; occipital spines usually less than one and one-half times their basal diameter 22
19. Frontal area of head concave; occipital spines nearly erect; temporal spines nearly horizontal; gular scales faintly keeled. Guanajuato and Hidalgo ..... *boucardii*

19′ Frontal area flat; occipital and temporal spines both horizontal; gular scales smooth 20

20. Temporal spines extending backward farther than occipital spines; femoral pores usually in single series. Veracruz, *orbiculare cortezii*

20′ Temporal spines equal to or shorter than occipital spines; femoral pores in single or double series 21

21. Occipital spines extending posteriorly beyond temporal spines; femoral pores often forming a double series mesially; ventral abdominal scales often covered with a dark reticulate pattern. Plateau of Mexico . . . . . *orbiculare orbiculare*

21′ Occipital spines and temporal spines projecting posteriorly an equal distance; femoral pores 14-14 confined to a single row; ventral abdominal scales not greatly darkened. Colima, *orbiculare dugesii*

22. Length of tail approximately equal to width of head; gular scales convex; chest scales faintly keeled. Durango and south central Chihuahua . . . . . *douglassii brachycercum*

22′ Length of tail considerable more than width of head; gular scales flat or slightly concave; chest scales smooth 23

23. Temporal area convex; lateral profile of temporal spines forming a curved line if projected to near tip of jaw; length of occipital and temporal spines less than their basal diameter, usually projecting vertically. Width of head at angle of jaw greater than across temporal area; temporal area and spines similar in color to remainder of head 24

23′ Temporal area flattened; lateral profile of temporal spines forming a straight line, if projected to angle of jaw; occipital and temporal spines usually as long as, or longer than, their basal diameter, and generally projecting horizontally; width of head at angle of jaw less than at temporal area; temporal area and spines often lighter colored than rest of head 25

24. Dorsal dark spots edged mesially and posteriorly in light cream; nostrils always piercing the snout laterally. New Mexico, southeastern Utah and southwestern Colorado, *douglassii ornatissimum*

24′ Dorsal dark spots edged only posteriorly in cream; nostrils often piercing snout anterolaterally. Western Kansas and Nebraska, eastern Colorado, Wyoming and Montana . *douglassii brevirostre*

25. Size large. Temporal spines one to one and one-half times as long as their basal diameter, usually projecting horizontally. Southern Utah, Arizona and northern Mexico, *douglassii hernandesi*

25′ Size small; temporal spines as long as their basal diameter; often projecting vertically 26

26. Ground color pale, and pattern often only vaguely discernible; central and northern Utah, and northeastern Nevada, *douglassii ornatum*

26′ Ground color generally dark; pattern distinct. Eastern Washington and Oregon, northeastern part of California, Idaho and and northeastern corner of Nevada . . . . *douglassii douglassii*

TAXONOMY

Phrynosoma braconnieri Aug. Duméril and Bocourt

Phrynosoma braconnieri Aug. Duméril and Bocourt, Mission Scientifique au Mexique et dans l'Amérique Centrale, Études sur les Reptiles, livr. 1, 1870, pl. 12, fig. 7, 7a-g; Bocourt, *idem*, livr. 4, 1874, pp. 233-234; Garman, Bull. Essex. Inst., vol. 16, 1884, p. 19; Boulenger, Catalogue of the Lizards in the British Museum of Natural History, vol. 2, 1885, p. 248; Gadow, Proc. Acad. Nat. Sci. Philadelphia, 1885, p. 147; Cope, Bull. U. S. Nat. Mus., no. 32, 1887, p. 39; Herrick, Terry & Herrick, Bull. Sci. Lab. Denison Univ., vol. 11, 1899, p. 134; Günther, Biologia Centrali-Americana, Reptilia and Batrachia, 1890, p. 79; Dugès, La Naturaleza, ser. 2, vol. 2, 1896, p. 479; Herrera, Católogo de la Colleción de Reptiles y Batracios, ed. 2, 1904, p. 19; Ditmars, Reptiles of the World, 1910, p. 151; Bryant, Univ. California Publ. Zool., vol. 9, 1911, p. 5; Smith, Trans. Kansas Acad. Sci., vol. 37, 1934, pp. 287, 288, 289, pl. 11, fig. 4; Smith and Laufe, Trans. Kansas Acad. Sci., vol. 48, 1945, p. 338; Smith and Taylor, Bull. U. S. Nat. Mus. no. 199, 1950, p. 100; Univ. Kansas Sci. Bull. vol. 33, pt. 2, 1950, p. 337.

Taxonomic history: This species was named and described by Aug. Duméril and Bocourt (1870) from specimens, in the Museum d'Histoire Naturelle de Paris, collected in Oaxaca by M. Jacob, Alfredo Dugès and A. Boucard. It was placed in the subgenus *Phrynosoma*. Subsequent workers have without exception given full specific rank.

Diagnosis: This small short-tailed species can be diagnosed by the following characters: nostrils within the canthal lines; one row of lateral abdominal spines; ventral scales keeled throughout; temporal spines much reduced; two moderately-developed occipital spines; tail greatly reduced, about one half the width of the head.

Description: Head slightly broader than long; nostrils small, within the canthal lines; internasal distance about three times the diameter of the nasal opening; frontal scales subequal; superciliary spines small; occipital spines short, heavy and divergent; temporal spines reduced to near size of adjoining scales; tympanum exposed; infralabials small, slightly enlarged posteriorly; separated from the small chinshields by a single row of small sublabials; gular scales small, imbricate and subequal; gular fold covered anteriorly with small scales and posteriorly with minute scales; dorsal scales mostly minute; a few enlarged dorsal scales arranged in longitudinal rows; tail short, about one half the head width; single row of lateral abdominal scales originating on the shoulder above the arm and extending to insertion of hind legs; ventral scales keeled throughout; eight or nine femoral pores on each side, separated mesially by about fifteen preanal scales.

Dorsal ground color yellowish gray; two indistinct dark neck spots; several indistinct dorsal body spots, the edges of which fade

into the ground color; a single, narrow, dark, transverse bar on tail; ventral surface yellow with small, dark spots.

Discussion: This rare species is easily recognized by its extremely short tail. Its affinities, although not close, appear to be nearest to the species *P. platyrhinos* and *P. modestum.* The exact measurements of the lizards available for this study are given in Table 2.

Distribution: This species has been reported from the Mexican states of Puebla and Oaxaca. It has been taken from near the border of Veracruz, and may be found to inhabit parts of that State also.

Locality records: MEXICO. *Oaxaca:* no specific locality (5 spec. Mus. d'Hist. Nat. Paris). *Puebla:* Tehuacán (USNM 47386, 11369); 10 mi. NE (EHT-HMS 10445); 22 mi. NE. (EHT-HMS 10444).

Phrynosoma platyrhinos platyrhinos Girard

Phrynosoma platyrhinos Girard, *in* Stansbury's Exploration and Survey of the Valley of the Great Salt Lake of Utah, 1852, pp. 354-363, pl. 7, figs. 1-5; Cope, Proc. Acad. Nat. Sci. Philadelphia, 1866, p. 302; Bocourt, Mission Scientifique au Mexique et dans l'Amérique Centrale; Études sur les Reptiles, livr. 4, 1870, pp. 232-233; Gentry, Proc. Acad. Nat. Sci. Philadelphia, 1885, p. 147; Stejneger, N. Amer. Fauna, no. 7, 1893, p. 190 (*part.*); Van Denburgh, Occas. Papers California Acad. Sci., no. 5, 1897, p. 98 (*part.*); McLain, Critical Notes on a Collection of Reptiles from the West Coast of North America, 1899, p. 8 (*part.*); Bryant, Univ. California Publ. Zool. vol. 9, 1911, pp. 44-50, pl. 2, figs. 5 and 6, figs. 13-14; Van Denburgh, Proc. California Acad. Sci., ser. 4, vol. 3, 1912, p. 137 (*part.*); Richardson, Proc. U. S. Nat. Mus., vol. 48, 1915, pp. 422-423; Van Denburgh & Slevin, Proc. California Acad. Sci., ser. 4, vol. 5, 1915, pp. 100, 105; Stejneger & Barbour, Check List of North American Amphibians and Reptiles, 1917, p. 60, (*part.*); Bently, Copeia, 1919, p. 90; Van Denburgh & Slevin, Proc. California Acad. Sci., ser. 4, vol. 11, 1921, pp. 40, 43; Van Denburgh, Occas. Papers California Acad. Sci., no. 10, vol. 1, 1922, pp. 421-426, pl. 36, figs. 1-3 (*part.*); Stejneger & Barbour, Check List of the North American Amphibians and Reptiles, 2 ed. 1923, p. 63 (*part.*); Tanner, Copeia, 1927, p. 56; Erwin, Eleventh Biennial Report of the Board of Trustees of the State Historical Society of Idaho, 1928, p. 32; Ruthven, Occas. Papers Mus. Univ. Michigan, no. 243, 1932, p. 3; Stuart, Occas. Papers Mus. Zool. Univ. Michigan, no. 244, 1932, pp. 1-33, pls. 1-2; Stejneger & Barbour, Check List of North American Amphibians and Reptiles, 3 ed. 1933, p. 69 (*part.*); Burt, Amer. Midl. Nat., vol. 14, 1933, p. 245; Knowlton & Janes, Copeia, 1934, pp. 13-14; Woodbury, Copeia, 1934, p. 52; Brooking, Copeia, 1934, p. 94; Knowlton & Thomas, Copeia, 1936, p. 65; Stejneger & Barbour, Check List of North American Amphibians and Reptiles, 4 ed. 1939, p. 75, (*part.*); Tanner, Proc. Utah Acad. Sci., vol. 16, 1939, p. 105 (*part.*); Gordon, Oregon State Mono., Studies in Zool., no. 1, 1939, pp. 15, 16, 47, 69; Linsdale, Proc. Amer. Acad. Arts and Sci., vol. 77, 1940, pp. 232-235, map (*part.*); Tanner, Great Basin Naturalist, vol. 1, 1940, p. 141, (*part.*); Slater, Occas. Papers Dept. Biol. College Puget Sound, no. 14, 1941, pp. 82, 93-94; Anderson & Slater, Occas. Papers Dept. Biol. College Puget Sound, no. 15, 1941, p. 111; Tanner, Great Basin Naturalist, vol. 2, 1941, p. 92; Driver, Name That Animal, 1942, p. 247 (*part.*).

Doliosaurus platyrhinos Girard, United States Exploring Expeditions for the years 1838, 1839, 1840, 1841, 1842, under the command of Charles Wilkes USN., vol. 20 Herpetology, 1858, p. 409; Girard, Report of the Explorations and Surveys to ascertain the most Practicable and Economic Rail Road Route to the Pacific Ocean, vol. 5, Report upon the Reptiles of the Route, 1859, p. 18 (*part.*).

Phrynosoma platyrhinum Cope, Bull. U. S. Nat. Mus., no. 1, 1875, p. 49; Yarrow, Report of the Geography and Geology of the Surveys West of the 100th Meridian, under Lt. Wheeler, vol. 5, Zoology, 1875, p. 578 (*part.*); Coues, *idem*, 1875, p. 594 (*part.*); Yarrow & Henshaw, Annual Report of the Chief of Engineers for 1878 of the Surveys West of the 100th Meridian, app. NN, 1878, p. 224, (*part.*); Yarrow, Bull. U. S. Nat. Mus., no. 24, 1883, pp. 11, 65 (*part.*); Ditmars, The Reptile Book, 1907, p. 158 (*part.*).

Phrynosoma platyrhinum Boulenger, Catalogue of Lizards in the British Museum of Natural History, vol. 2, 1885, p. 247 (*part.*).

Anota platyrhina Cope, Rept. U. S. Nat. Mus. for 1898, (1900), pp. 443-447, fig. 81 (*part.*).

Phrynosoma platyrhinos platyrhinos Klauber, Copeia, 1935, pp. 178-179; Graf & Jewett, Copeia, 1939, p. 103; Owen, Copeia, 1940, p. 170; Johnson, Copeia, 1942, p. 16; Stejneger & Barbour, Bull. Mus. Comp. Zool. Harvard Coll., vol. 19, 1943, p. 95 (*part.*); Evender, Copeia, 1946, p. 257; Smith & Taylor, Univ. Kansas Sci. Bull., vol. 33, pt. 2, 1950, pp. 363, 375 (*part.*); Smith & Taylor, Bull. U. S. Nat. Mus. no. 199, 1950, p. 101 (*part.*).

Taxonomic history: Girard (1852:354) named this species from specimens collected by the Stansbury Expedition to the Great Salt Lake. The latter was given as the known distribution, and remains as the type locality of the form. In the collection at the United States National Museum, three specimens (Cope 1900:466 listed four specimens) all under No. 189 from Salt Lake Valley, Utah, seem to be the specimens used by Girard in his description, and have been designated as the types on the records of that Museum. Other specimens, (No. 190, with three specimens and 191 with five specimens), were also taken by members of the same military company.

Cope (1900) placed *platyrhinos* along with *m'callii* and *calidiarum* in the genus *Anota* based on the concealment of the tympanum by a scaly integument. The character is not constant in *platyrhinos* and *calidiarum;* therefore Cope's arrangement was discarded. Klauber (1935) finding intergrading trends between *platyrhinos* and *goodei,* reduced both to subspecific rank.

Diagnosis: Occipital horns moderately long (usually less than 45 percent of head length); tail round; five to six temporal horns each being slightly longer than the preceding one; interoccipital space approximately equal to basal diameter of spine.

Description: Head slightly longer than broad; frontal area inclined forward, center indented by groove from occipital shelf; rostro-frontal angle acute; nostrils within the canthal line, separated by a distance equal to three times their diameter; superciliary

ridge prominent, composed of four or five enlarged scales; superciliary spine short, broad; posterior limits of frontal area indented; occipital spines moderately long, less than 45 percent of head length, slender; interoccipital space approximately equal to basal diameter of one spine; interoccipital spine small; temporal area moderately expanded; five temporal spines enlarging posteriorly, last approximately one half size and length of occipital; supralabials 10-10, small and serrate; infralabials small, inconspicuous, separated from chinshields by one row of sublabials; chinshields 8-8, increasing in size posteriorly, penultimate largest; gulars subequal except for one row of slightly enlarged scales on each side; two lateral neck patches of enlarged soft spines, lower larger; tympanum exposed; dorsal scales small, smooth, imbricate; enlarged keeled scales few, largest forming a single paired row next to and paralleling vertebral column; two rows of slightly enlarged scales on tail; ventral scales smooth; femoral pores 11-12; rows separated mesially by three preanal scales.

Dorsal ground color light bluish gray; nuchal and body markings brownish black, interspersed with ground color; three irregular transverse bars across back, expanding laterally to form a nearly-solid lateral longitudinal stripe; tail traversed by six dark bands; head olive-gray, with brown to black flecks usually on tips of scales; ventral gular area and abdominal area spotted with black; several larger brown to black spots on preanal area and posterior part of hind limbs.

Variation: Counts of the scales and pores will vary slightly from that given. The length of the occipital spine may approach half the length of the head in a few specimens, especially in those from areas where *P. p. platyrhinos* intergrades with *P. p. calidiarum*. The ground color will vary with the substratum but is generally darker than in the southern subspecies.

Locality records: CALIFORNIA. *Lassen Co.:* Litchfield, 5 mi. E (MVZ 36086); Warm Springs (MVZ 24514-15), 1 mi. S (MVZ 24516) 3 mi. NW (MVZ 24513).

NEVADA. *Churchill Co.:* Fallon (USNM 118606), 5 mi. N (MVZ 20106); Soda Lake, 3 mi. NW (MVZ 28586); *Elko Co.:* Wendover, 3 mi. S (MVZ 12319); *Eureka Co.:* Beowawae (USNM 45290); Emigrant Pass, 3 mi. W (MVZ 18456); Romano, 4 mi. SE (MVZ 20615); Tenabo, 12 mi. NNE (MVZ 20618); *Humboldt Co.:* Golconda, 1 mi. S (MVZ 20611), 5 mi. NE (MVZ 20613), 6 mi. SE (MVZ 30170-73, 30174-79); Golconda (USNM 45289); *Lander*

Co.: Battle Mountain, 14 mi. N (MVZ 20606); Birch Creek Ranch, 6 mi. S (MVZ 12147); Tenabo, 10 mi. NNE (MVZ 20616-17); *Lincoln Co.:* Panaca (USNM 18378-80), 21 mi. W (MVZ 14251-52); Sand Springs (MVZ 14249); no specific locality (USNM 18382-83); *Lyon Co.:* Dayton, 6½ mi. E (MVZ 20110); Fallon, 22 mi. W (MVZ 20107), 27½ mi. W (MVZ 20109); Wabaska, 10 mi. E (MVZ 32096); Wellington, 10 mi. E (MVZ 17117); Yerington, 11 mi. S, 2 mi. E (MVZ 17120); *Mineral Co.:* Huntoon Valley (MVZ 10861); Morgan's Ranch, 2 mi. NW (MVZ 17110); Pine Grove, 6 mi. NE (MVZ 17116); Wichmann (MVZ 36297); *Nye Co.:* Daylight Springs (LMK 22135); Hot Creek, 10 mi. N (MVZ 16222); Millet, 5 mi. S (MVZ 12143, 14366); North Twin River (MVZ 16177); Round Mountain (USNM 52448-49); Toquema Range, Jefferson Creek (USNM 52446); Toyabe Range, Peavine Creek (USNM 52447); Wisconsin Creek (MVZ 12824). *Ormsby Co.:* Carson City (USNM 44814-15). *Pershing Co.:* Fanning, 10 mi. E, 3 mi. S (MVZ 21470); Lovelock, 30 mi. W, 4 mi. N (MVZ 21478); Sulphur, 10 mi. W, 6 mi. N (MVZ 21476); Toulon, 3 mi. NNE (MVZ 18453-54); Vernon, 3 mi. S (MVZ 21472). *Storey Co.:* Virginia City (USNM 8650). *Washoe Co.:* Gerlach, 2½ mi. E, 11 mi. N (MVZ 21483, 21487-88); Little High Rock Canyon (MVZ 7533, 7536-38, 7540-41); Pahrum Peak, 4 mi. W (MVZ 24520); Pyramid Lake, East Shore (LMK 38318-19), (USNM 9515, 44813, 50700-03, 50814-19, 58660), Sutcliff (LMK 27293); Reno (USNM 44817-18, 79355-56), 10 mi. E (MVZ 14927), 25 mi. N (MVZ 25324); Smoke Creek 100 yds. E California line (MVZ 20476); Wadsworth (USNM 44812, 50704). *White Pine Co:* Baker (MVZ 11326, 11329-33), 4 mi. NE (USNM 86955); Hamilton, 3 mi. SW (MVZ 12318); Smith Creek Cave (MVZ 42521), 1 mi. SE (MVZ 24503-31), 3 mi. E (MVZ 24527-29); Smoke Creek Desert (USNM 45285-88).

Idaho. *Ada Co.:* Boise (BYU 8064-65), USNM 63266), 15 mi. S (BYU 8061). *Canyon Co.:* Snake River, near Givens (LMK 1448-49. *Elmore Co.:* Cleft, 4 mi. S (USNM 65192-94); no specific locality (USNM 58616). *Owyhee Co.:* Indian Cave (BYU 8060); Murphy (USNM 48153); no specific locality (USNM 42131). *Payette Co.:* Payette (USNM 45231-32).

Oregon. *Harney Co.:* Alvord Lake (USNM 44673). *Malheur Co.:* White Horse Creek (USNM 53042-43).

Utah. *Beaver Co.:* Cove Fort (BYU 8034); Jackson Hill (USNM 36351). *Box Elder Co.:* Kosmo (LMK 26707); Locomotive Springs

(LMK 26708); Promontory Ridge (LMK 23594); Snowville (LMK 24995-96). *Carbon Co.:* Price (BYU 8029, 8031, 8033). *Juab Co.:* Callio (BYU 8091, 8022-23); Trout Creek (UU 1217-18), (LMK 22995). *Millard Co.:* Delta, 5 mi. N (LMK 897), 20 mi. NW (LMK 660); Gandy (BYU 9021); Fillmore (Ruthven, 1932); Hinckley, 10 mi. W (BYU 8028), 15 mi. S (BYU 4313); Middle Pahvant Valley (Stuart, 1932); Simpson's Ranch, 2 mi. E (Burt, 1933). *Salt Lake Co.:* Salt Lake (USNM 189, 190, 4980). *San Pete Co.:* Indianola (BYU 8032). *Sevier Co.:* Monroe (LMK 39394), 5 mi. SW (LMK 38266), 5 mi. W (LMK 38383-84), 12 mi. W (LMK 37871-73, 37945-50). *Tooele Co.:* Cedar Mts. (UU 202); Delle (UU 937); Gold Hill (BYU 2024, 8030), (UU 2119); Grantsville (UU 2007); Iosepa (LMK 26706), 15 mi. N (BYU 8039-44), 18 mi. N (BYU 8020); Low (UU 936); Orr's Ranch (UU 2233), 8 mi. N (LMK 22994, 26709); Willow Springs (UU 1224a). *Uintah Co.:* Jensen, 25 mi. SE (UU 2637); Ouray, 3 mi. E (UU 345). *Utah Co.:* Cedar Fort (USNM 44761); Fairfield (USNM 8107); Goshen (BYU 8063, 8066); Lehi, 4 mi. W (BYU 2086, 2090, 2781); Provo (BYU 4314); Utah Lake, west of (UU 2210-16, 2023-25, 2069-74). *Weber Co.:* Ogden (UU 1699).

WASHINGTON. *Walla Walla Co.:* Fort Walla Walla (USNM 10832).

Phrynosoma platyrhinos calidiarum (Cope)

Phrynosoma platyrhinos Stejneger, N. Amer. Fauna, no. 7, 1893, p. 190, pl. 2, figs. 4a-c (*part.*); Van Denburgh, Occas. Papers California Acad. Sci., no. 5, 1897 (*part.*); McLain, Critical Notes on a collection of Reptiles from the West Coast of North America, 1899, p. 8 (*part.*); Grinnell & Grinnell, Throop Inst. Bull., no. 35, 1907, p. 57; Bryant, Univ. California Publ. Zool., vol. 9, 1911, pp. 4, 44-50, pls. 2, 6 (*part.*); Van Denburgh, Proc. California Acad. Sci., ser. 4, vol. 3, 1912, p. 157, Van Denburgh & Slevin, Proc. California Acad. Sci., ser. 4, vol. 3, 1913, pp. 393, 406; Atsatt, Univ. California Publ. Zool., vol. 12, 1913, p. 38; Camp, Univ. California Publ. Zool., vol. 17, 1916, p. 527; Stejneger & Barbour, Check List of North American Amphibians and Reptiles, 1917, p. 60 (*part.*); Hall & Grinnell, Proc. California Acad. Sci., ser. 4, vol. 9, 1919, p. 48; Nelson, Mem. Nat. Acad. Sci., vol. 16, 1922, p. 114; Stejneger & Barbour, Check List of North American Amphibians and Reptiles, 2 ed., 1923, p. 63 (*part.*); Tanner, Copeia, 1927, p. 56 (*part.*); Springer, Copeia, 1928, pp. 101-102; Woodbury, Copeia, 1928, p. 17; Klauber, Bull. Zool. Soc. San Diego, no. 4, 1928, p. 3 and *idem*, no. 5, 1930, p. 4; Bogert, Bull. So. California Acad. Sci., vol. 29, 1930, p. 8; Linsdale, Univ. California Publ. Zool., vol. 38, 1932, p. 349; Stejneger & Barbour, Check List of North American Amphibians and Reptiles, 3 ed. 1933, p. 69 (*part.*); Klauber, Bull. Zool. Soc. San Diego, no. 11, 1934, p. 12; Gloyd, Bull. Chicago Acad. Sci., vol. 5, 1937, p. 112; Stejneger & Barbour, Check List of North American Amphibians and Reptiles, 4 ed., 1939, p. 75 (*part.*); Cowles, Science, NS, vol. 90, 1939, pp. 465-466; Tanner, Proc. Utah Acad. Sci., vol. 16, 1939, p. 105, (*part.*); Great Basin Naturalist, vol. 1, 1940, p. 141 (*part.*); Linsdale, Proc. Amer. Acad. Arts.

and Sci., vol. 77, 1940, pp. 232-235, map (*part.*); Driver, Name That Animal, 1942, p. 347 (*part.*); Miller, Copeia 1948, p. 67.

Doliosaurus platyrhinos Baird, Report of the Exploration and Surveys to ascertain the most Practicable and Economic Rail Road Route, to the Pacific Ocean, vol. 5, Report upon the Reptiles of the Route, 1859, p. 18 (*part.*).

Phrynosoma platyrhinum Yarrow, Report of the Geography and Geology of the Surveys West of the 100th Meridian, under Lt. Wheeler, vol. 5, Zoology, 1875, p. 578 (*part.*); Coues, *idem*, 1875, p. 594 (*part.*); Yarrow & Henshaw, Annual report of the Chief of Engineers for 1878, Survey West of the 100th Meridian, Appendix NN, 1878, p. 224, (*part.*); Yarrow, Bull. U. S. Nat. Mus., no. 24, 1883, pp. 11, 65 (*part.*); Ditmars, The Reptile Book, 1907, p. 158 (*part.*).

Phrynosoma mccallii Yarrow & Henshaw, Annual Report of the Chief of Engineers for 1878, Survey West of the 100th Meridian, Appendix NN, 1878, p. 225; Yarrow, Bull. U. S. Nat. Mus., no. 24, 1883, p. 65; Boulenger, Catalogue of Lizards in the British Museum (Natural History), vol. 2, 1885, p. 246.

Phrynosoma platyrhinus Boulenger, Catalogue of Lizards in the British Museum (Natural History), vol. 2, 1885, p. 247 (*part.*); Meeks, Field Columbian Mus. Zool. Ser., vol. 7, 1906, p. 12.

Anota calidiarum Cope, Amer. Nat., vol. 30, 1896, p. 833; Cope, Rept. U. S. Nat. Mus. for 1898, (1900), p. 439, fig. 79.

Anota platyrhina Cope, Rept. U. S. Nat. Mus. for 1898 (1900), p. 443, fig. 81 (*part.*).

Phrynosoma calidiarum Ditmars, The Reptile Book, 1907, p. 157, pls. 46, figs. 10, 14, and 50, fig. 2.

Phrynosoma platyrhinus Stephens, Trans. San Diego Soc. Nat. Hist., vol. 3, p. 62.

Phrynosoma platyrhinos platyrhinos Klauber, Copeia, 1935, pp. 178-179; Cowles & Bogert, Herpetologia, vol. 1, 1936, p. 38; Fitch, Herpetologia, vol. 1, 1939, p. 151, Klauber, Bull. Zool. Soc. San Diego, no. 14, 1939, pp. 94-95; Stejneger & Barbour, Bull. Mus. Comp. Zool. Harvard Coll., vol. 93, 1943, p. 95 (*part.*); Lowe, Herpetologia, vol. 4, 1947, p. 77; Smith & Taylor, Bull. U. S. Nat. Mus., no. 199, 1950, p. 101 (*part.*); Univ. Kansas Sci. Bull. vol. 33, pt. 2, 1950, pp. 363, 375 (*part.*).

Taxonomic history: This form was first described as *Anota calidiarum* by Cope (1896:833) from a specimen, in the United States National Museum, taken in Death Valley, California. It was placed in the synonymy of *P. platyrhinos* by subsequent workers.

Diagnosis: Occipital horns heavy and long (45 percent or more of head length); interoccipital space one half basal diameter of occipital spine; five to six temporal spines each longer than the one preceding it; tail often somewhat flattened posteriorly.

Description: Head slightly longer than broad; frontal area inclined forward; rostrofrontal angle abrupt; nostrils within canthal lines, medium size, separated by a distance equal to approximately three times their diameter; superciliary ridge distinct, ending posteriorly in a broad triangular superciliary spine; posterior edge of frontal area notched; shallow groove extending from notch to rostrum; occipital spines long and heavy; interoccipital space equal to approximately one half basal diameter of one occipital spine; small interoccipital; enlarged scale at outer base of occipital; tem-

poral shelf moderately expanded; six temporal spines, increasing in size posteriorly, last spine approximately one half size of occipital; occipitotemporal space equal to basal diameter of occipital spine; supralabials small, serrate, 9-9; infralabials small, inconspicuous; chinshields increasing in size posteriorly, penultimate largest; chinshields and infralabials separated by a single row of sublabials; gular scales subequal, one slightly enlarged row on either side; two lateral neck patches of enlarged scales, upper smallest; tympanum free of scaly integument, hidden by fold of skin; dorsum covered with small, smooth, imbricate scales, with a few moderately enlarged keeled scales scattered over back and tail; one row of enlarged soft spines in lateral fringe; ventral scales smooth throughout; femoral pores 8-8, the rows separated mesially by six preanal scales.

Dorsal ground color light yellowish tan; nuchal blotches light gray to black; three gray to black dorsal blotches forming indistinct transverse bands across back; five wide transverse bars on tail; color of venter ivory throughout.

Variation: The length of the occipital spines varies from 47 percent of the head length to a maximum of 60 percent. Accompanying the increase in length is a more noticeable increase in the diameter of the spine giving it a heavy, stout appearance. Either the sixth, fifth or fourth temporal spine may be absent, in which case the bases of those remaining are in contact with each other maintaining an unbroken contour. Near the center of the geographic range of the subspecies, the largest of the temporal spines is normally one-half as large as an occipital spine, but may be smaller in specimens from the outer part of the range.

The tympanum may be partly exposed or completely concealed by a scaly integument, but usually it is hidden by a fold of skin in the lateral neck region.

The general ground color varies with the substratum upon which the animal lives and usually it is lighter than that of the more northern subspecies, *P. p. platyrhinos.*

Discussion: The extensive distribution and altitudinal range of the form heretofore known as *P. platyrhinos platyrhinos* has caused many workers to wonder whether several forms were not involved. After an extensive study of several hundred specimens from all parts of the range, the only division that seems justifiable is the separation of the form here called *P. p. calidiarum.* Cope described *Anota calidiarum*, from specimens taken in Death Valley, California, which

falls within the range of the revived form. It therefore, seems proper to apply that name to the subspecies here defined.

Locality records: Arizona. *Coconino Co.:* Lee's Ferry (UU 1459), (USNM 44632-33); Pipe Springs (SSNH 12744). *Maricopa Co.:* Forepaugh (LMK 26961); Gila Bend (SSNH 17150), (LMK 35180), 1 mi. S (LMK 37734), 4 mi. N (SSNH 14181-83), 30 mi. E (SSNH 17090); Phoenix (USNM 45115); Piedra (LMK 27126); Sentinel (SSNH 15207); Stanwix (LMK 27125); no specific locality (USNM 61387). *Mohave Co.:* Chemehuevis Mts. Lucky Star Mine (SSNH 17179-80); Hackberry (USNM 60174); Sacramento Valley, south end (SSNH 17183-84); Virgin Valley (USNM 18363-73); Wolf's Hole, 4 mi. N (SSNH 17151-55). *Pima Co.:* Ajo, 3½ mi. S (LMK 39115), 6½ mi. S (LMK 39111), 9½ mi. S (LMK 38516). *Yavapai Co.:* Congress Junction, 4 mi. S (LMK 32377). *Yuma Co.:* Dome, 15 mi. N (LMK 39749); Kofa Mts., Del Oso Pass (SSNH 17976-77); Mohawk (LMK 34926); Mohawk Valley (LMK 23602); Parker Indian Agency (USNM 16804); Stoval, 2 mi. N (SSNH 13919); Tinajas Altas (SSNH 17058), (LMK 27014), (USNM 21726); Tule Tanks (LMK 34925); Yuma Desert (LMK 23601).

California. *Imperial Co.:* Chocolate Mts. (LMK 33941-42); Colorado Desert (USNM 8649); Coyote Well (MVZ 1000), (SSNH 11297, 12078), (LMK 34589), (USNM 21962-63); Mountain Spring (LMK 10938); Niland, 5 mi. S (SSNH 15558); Ocotello (LMK 25528); Painted Gorge (SSNH 13921); Potholes (LMK 2448); Yuha Well (LMK 31234). *Inyo Co.:* Argus Mountains (USNM 18431-34), Junction Ranch (SSNH 16986-87); Caso Mountains, north end (LMK 25367); Death Valley (USNM 18411, 64283); Bennett's Well (USNM 8412); Deep Springs Valley (MVZ 31706-07); Emigrant Canyon, Panamint Mts. (MVZ 6638-39); Funeral Mountains (LMK 2534-37); Furnace Creek Ranch (MVZ 7438, 6630, 6637), (USNM 18413-14); Furnace Wash (MVZ 6343); Independence (USNM 18439-41); Keeler (MVZ 3688); Little Lake (LMK 38325), 2 mi. S (LMK 25368); Lone Pine, 3 mi. W (MVZ 6644); Mountain Springs Canyon (MVZ 35829); Owens Lake (USNM 18429); Owens Valley (USNM 18430); Panamint Range (USNM 18417-21); Panamint Valley (USNM 18523-38, 64277-82); Shoshone, 2 mi. N (MVZ 6641); Telescope Peak, Johnson's Canyon (MVZ 4461); Towne's Pass, 2 mi. N (LMK 25369), 5 mi. N (LMK 25370), 6 mi. N (LMK 25371); Walker Creek (MVZ 38392). *Kern Co.:* Chimney Creek (MVZ 2873-77); China Lake (LMK 22202-03); Johannesburg

(MVZ 26033); Red Rock Canyon (LMK 22136); Randsburg (SSNH 21312); Weldon, 16 mi. SSE (MVZ 2879). *Los Angeles Co.:* Antelope Valley (USNM 54813); Coas (USNM 18435); Llano, 10 mi. E (LMK 29204); Lone Mills (USNM 58662-64); Love Joy Spring (USNM 81081); Palmdale (LMK 33436, 34367); Pearblossom, 4 mi. SE (LMK 37430-31); no specific locality (MVZ 3511). *Mono Co.:* Benton (MVZ 3694), 5 mi. N (SSNH 16273); Benton Sea, 2 mi. S (MVZ 3693). *Riverside Co.:* Blythe, 20 mi. W (LMK 39768); Cottonwood Springs (MVZ 4115-16); Desert Center (LMK 2755, 4310-11, 4341-42, 4512, 4856-57), 14 mi. W (LMK 39767); Garnet (LMK 39771-73), (USNM 75136); Hopkin's Well, 4 mi. W (LMK 39774); Little San Francisco Mts., Berdoo Canyon (LMK 31625, 31627, 33111); Mecca, 60 mi. E (MVZ 7867-70); Palm Springs (USNM 18443, 19096-97, 26375), 8 mi. SE (SSNH 13920); Palm Springs Canyon (LMK 34257); Imperial Valley (USNM 75125). *San Bernardino Co.:* Amboy (LMK 7620), 14 mi. S (LMK 39906); Atolia (SSNH 12319); Barstow (USNM 44616), (MVZ 10748), 3 mi. NE (LMK 35653); Blythe Junction, 4 mi. E (MVZ 5495), 14 mi. NE (MVZ 5496); China Lake (LMK 22134); Cronise, 4 mi. E (LMK 39910); Dagget (LMK 7615); Drinkwater Springs (MVZ 18029); Grommet, half way between & Rose (LMK 37651-57); Hodge (LMK 23373); Ibex Pass, 7 mi. S (LMK 39915); Jim Gray (LMK 31720); Klinefelter (LMK 7621); Lavic (LMK 10643), 7 mi. S (MVZ 7444, 7447); Lucerne (LMK 27327); Ludlow (USNM 45179); Mace (LMK 28932); Mohave Desert (USNM 9195, 8651); Mountain Pass, U. S. Highway 91 (LMK 25527); Needles (MVZ 1103-04, 4255), 15 mi. W (LMK 20989), 25-50 mi. W (LMK 38706-07); Old Woman Spring (LMK 27330); Oro Grande (MVZ 7448); Red Mountain (LMK 28933); Rock Corral, 3 mi. E (LMK 31626); Twenty-nine Palms (LMK 8501), north of (LMK 32988-89), 10 mi. E (LMK 39925, 40022), 13 mi. E (LMK 39923); Two Springs (MVZ 18030); Victorville (USNM 44615); Virginia Dale Mine, 1 mi. S (MVZ 44611-12); Walker Station (LMK 25582); Windmill, 3 mi. N (LMK 27322). *San Diego Co.:* Agua Caliente (SSNH 16543); Benson's Dry Lake (SSNH 16726), (LMK 22849, 23701, 23935-36, 24035, 26960, 27324, 33336); Box Canyon (SSNH 11076); Borego Valley (LMK 22137, 26796, 27401); Coyote Creek (LMK 25304); Hodge (LMK 2538); La Puerta (SSNH 11295, 11298-99, 11405, 11701), (LMK 23372); Narrows (LMK 23934); Palm Springs (SSNH 11497, 11077-87); San Felipe Canyon (SSNH 11296); San Felipe Valley (SSNH 16544); Top of Sentenac Canyon (LMK

29494); Vallecitos (LMK 38101); Yaqui Well (LMK 25889); Yaqui Pass (LMK 33761). *San Luis Obispo Co.:* Shandon, 7 mi. SE (LMK 37539).

Baja California. Seven Wells, Colorado Desert (USNM 21964); Montes de Nedia, E base San Pedro Mártir Mountains near San Felipe (LMK 25252); Pozo San Augustín (USNM 37591); San Felipe, 1 mi. N (LMK 38264), 20 mi. N (LMK 38067-68), 50 mi. N (LMK 38069).

Nevada. *Clark Co.:* Boulder Dam (BYU 8038, 455); Boulder City (USNM 101154); Charleston Park, 12 mi. E (MVZ 20103); Fort Mohave, 1½ mi. NW (MVZ 20099-100); Indian Springs, 1 mi. S (LMK 27701); Jean, 10 mi. S (LMK 25888, 29228); Las Vegas (USNM 18391-92), 8 mi. NW (LMK 29093-94); Mesquite (SSNH 12745); Potosi Mountains, 3 mi. N, 6 mi. W (MVZ 35833), 9 mi. W, 2 mi. N (MVZ 35834); Virgin River Narrows, Meade Lake (BYU 4311-12). *Esmeralda Co.:* Arlemont (MVZ 10604, 10606), 7 mi. N (MVZ 10609, 10612-13, 10617-19, 10623); Cane Springs (MVZ 10825, 10830); Fish Lake (MVZ 10826); Gap Springs (MVZ 10616); Tonopah, 12½-13½ mi. W (LMK 37540-42). *Lincoln Co.:* Carp, 4 mi. NE (MVZ 20101); Crystal Springs (MVZ 14240-41, 14236, 14250), 1½ mi. NE (MVZ 14244); Dead Mountains, Hiko Springs (MVZ 19300); Groom Baldy Mt., 14 mi. NNW (MVZ 14253). *Nye Co.:* Amargosa Desert (USNM 18393-95); Ash Meadow (USNM 18396-406, 64384); Grapevine Mountains (USNM 18381); Grapevine Peak, 6 mi. E, 1 mi. N (MVZ 35830-31); Springdale, west of (MVZ 35832); Stonewall Mountains, west side (MVZ 36079-80).

Utah. *Washington Co.:* Beaver Dam (UU 1955, 1982), mountains (BYU 2735), slope (UU 1941, 1952-54, 1956-57, 1983, 2815); Bloomington (UU 370); Harrisburg (LMK 25583); Hurricane (UU 692); (BYU 3364-65); Mountain Meadow (USNM 18377); St. George (USNM 18374-76, 9403, 44723), (UU 389, 2816), (LMK 23809-10), 3 mi. S (UU 439); Springdale (LMK 24994); Washington, 4 mi. E (LMK 25529); Zion National Park (UU 438).

Phrynosoma platyrhinos goodei Stejneger

Phrynosoma hernadezi Streets, Bull. U. S. Nat. Mus., 1877, no. 7, p. 36.
Phrynosoma goodei Stejneger, N. Amer. Fauna, no. 7, 1893, p. 191, pl. 11, figs. 3a-c; Ditmars, Reptiles of the World, 1910, p. 151; Van Denburgh, Occas. Papers California Acad. Sci., no. 10, vol. 1, 1922, pp. 368, 426-427.
Anota goodei Cope, Ann. Rept. U. S. Nat. Mus. for 1898 (1900), pp. 436, 442, fig. 80.

Phrynosoma platyrhinos goodei Klauber, Copeia 1934, no. 4, pp. 178-179; Smith, Annals Carnegie Mus., vol. 27, 1939, p. 315; Smith & Laufe, Trans. Kansas Acad. Sci., vol. 48, 1945, p. 338; Smith & Taylor, Univ. Kansas Sci. Bull., vol. 33, pt. 2, 1950, p. 344; Bull. U. S. Nat. Mus. no. 199, 1950, p. 102.

Diagnosis: Three enlarged temporal spines, the last equal in size to the occipital spines; last three chinshields greatly enlarged and pointed.

Description: Head equally as broad as long; rostrofrontal angle abrupt (60°-70° angle); frontal area flat, posterior border indented to approximately one half frontal length; superciliary ridges prominent, scales enlarged, terminating posteriorly in slightly enlarged pyramidal scale; nostrils within canthal lines, separated mesially by distance equal to twice diameter of nostril; occipital spines moderately large, separated by distance approximately equal to their basal diameter; small interoccipital present; two enlarged tubercles on frontal shelf in contact with an enlarged scale pierced by pineal foramen; three temporal horns, last largest, somewhat separate from other two, approximately equal to occipitals; two enlarged tubercles anterior to first temporal; tympanum concealed; supralabials and infralabials small and inconspicuous; chinshields 7-7, last three greatly enlarged and pointed; one paired row of slightly enlarged scales on gular; two lateral neck patches of soft spines, the lower larger; back covered with minute scales interspersed with varying sizes of larger keeled scales; largest dorsal scales surrounded by rosette of smaller scales, former arranged in three pairs of indistinct longitudinal rows; tail scalation similar to that of back; enlarged scales fewer and smaller; one row of enlarged soft spines in lateral abdominal fringe; latter extending from shoulder to groin; dorsal humeral scales enlarged and keeled; single row forming fringe on posterior border of forearm; leg with scattered enlarged scales; ventral scales smooth; femoral pores 10-10; rows separated mesially by five preanal scales.

Color of head uniform light tan with few minute dark spots; body ground color light gray with pattern of darker tans and browns; nuchal blotches confined mainly to neck, extending onto shoulder only short distance; dorsal spots indistinct, some appearing as irregular dark transverse strips; tail with several narrow dark bands; general over-all dorsal coloration faded, ventral scales light throughout.

Variation: In the eight adult specimens available for this study only minor variations were found in the diagnostic characters.

The size and placement of the temporal spines varied only slightly from that given above. The femoral pores vary in number from 5-6 to 11-11, the latter being that of the type specimen. Four to eight preanal scales separate the rows mesially. The dorsal ground color varies from a light tan to a medium gray, but is lighter than the general color of *P. p. calidiarum*.

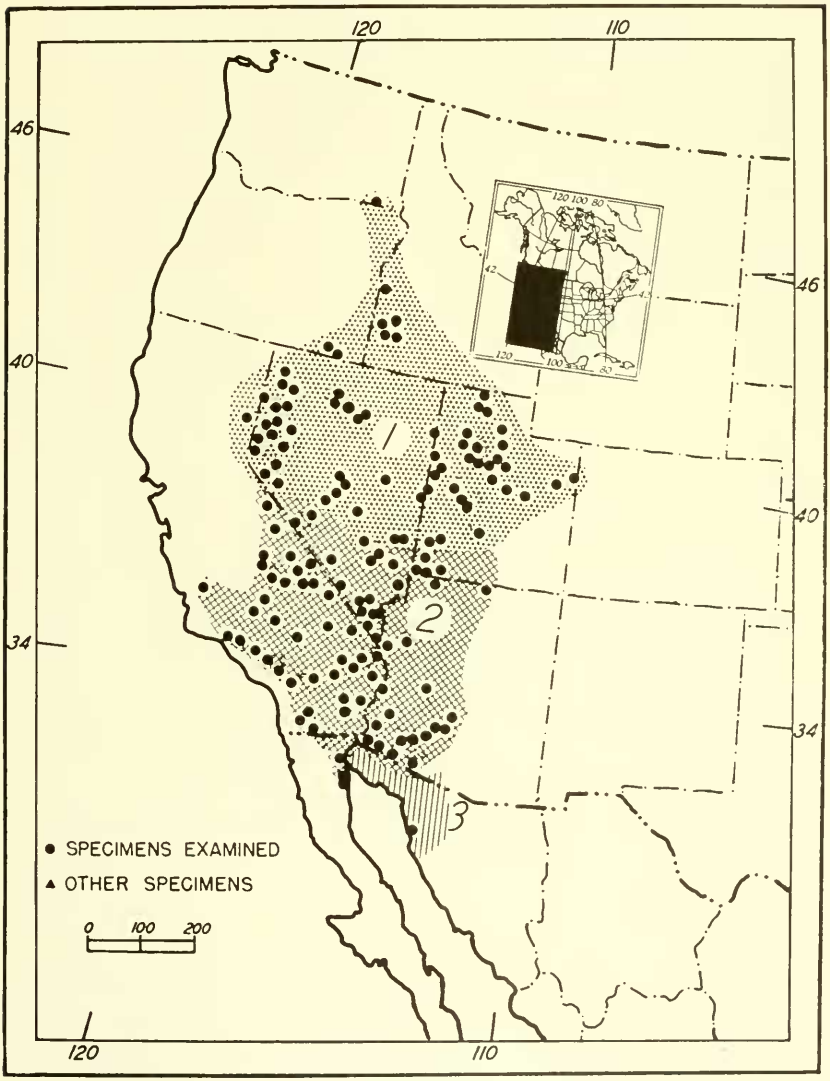


FIG. 3. Map showing the geographic distribution of the species *Phrynosoma platyrhinos*

1. *Phrynosoma p. platyrhinos* 2. *Phrynosoma p. calidiarum*
3. *Phrynosoma p. goodei*

General distribution: Western part of Sonora.

Locality records: SONORA. Álamo Muerto, NW of, (MVZ 10166). Puerto Libertad (SSNH 16693). (AMNH 69653-56); West Coast (USNM 8567a type & 8567b).

Phrynosoma m'callii (Hallowell)

Anota m'callii Hallowell, Proc. Acad. Nat. Sci. Philadelphia, vol. 6, 1852, p. 182; Hallowell, Sitgreaves' Expedition down the Zuni and Colorado Rivers, 1853, p. 127, pl. 10; Bocourt, Mission Scientifique Mexique et dans l'Amérique Centrale, Études sur les Reptiles, livr. 4, 1874, p. 230.

Doliosaurus m'callii Girard, United States Exploring Expeditions of the years 1838, 1839, 1840, 1841, 1842, under the command of Charles Wilkes USN, vol. 20, Herpetology, 1858, p. 408; Baird, United States Mexican Boundary Survey under the order of Lieut. Col. W. H. Emory, Reptiles of the Boundary, vol. 2, 1859, p. 9, pl. 28, figs. 4-6; Cooper, Proc. California Acad. Sci., vol. 4, 1870, p. 67.

Phrynosoma maccallii Cope, Proc. Acad. Nat. Sci. Philadelphia, 1866, p. 310; Cope, Bull. U. S. Nat. Mus., no. 24, 1875, pp. 11, 65; Gentry, Proc. Acad. Nat. Sci. Philadelphia, 1885, p. 148.

Anota maccallii Cope, Report U. S. Nat. Mus. for 1898, (1900), p. 448, fig. 82; Bryant, Univ. California Publ. Zool., vol. 9, 1911, pp. 54, 55, pl. 7.

Phrynosoma m'callii Stejneger, N. Amer. Fauna, no. 7, 1893, p. 190; Van Denburg, Occas. Papers California Acad. Sci., no. 5, 1897, pp. 89, 100-101; Ditmars, Reptiles of the World, 1910, p. 151; Van Denburgh, Occas. Papers California Acad. Sci., ser. 4, vol. 3, 1912, p. 153; Van Denburgh & Slevin, Proc. California Acad. Sci., ser. 4, vol. 3, 1913, pp. 392, 406; Grinnell & Camp, Univ. California Publ. Zool., vol. 17, 1917, no. 10, p. 166; Stejneger & Barbour, Check List of North American Amphibians and Reptiles, 1917, p. 59; Hall & Grinnell, Proc. California Acad. Sci., ser. 4, vol. 11, 1919, p. 51; Van Denburgh, Occas. Papers California Acad. Sci., no. 10, vol. 1, 1922, pp. 428-340, pl. 37; Stejneger & Barbour, Check List North American Amphibians and Reptiles, 2 ed., 1923, p. 62; Klauber, Bull. Zool. Soc. San Diego, no. 4, 1928, p. 4, and 1930, *idem*, no. 5, p. 4; Klauber, Copeia, 1932, no. 2, p. 100; Cuesta Terron, Anal. Inst. Biol., vol. 3, 1932, pp. 118-119; Stejneger & Barbour, Check List of North American Amphibians and Reptiles, 3 ed., 1933, p. 68; Klauber, Bull. Zool. Soc. San Diego, no. 11, 1934, p. 12; Smith, Trans. Kansas Acad. Sci., vol. 37, 1934, p. 287; Mosauer, Ecology, vol. 16, 1935, p. 19; Burt, Trans. Kansas Acad. Sci., vol. 38, 1936, p. 261; Klauber, Bull Zool. Soc. San Diego, no. 14, 1939, p. 95; Cowles, Science, NS., vol. 90, 1939, pp. 465-466; Stejneger & Barbour, Check List of North American Amphibians and Reptiles, 4 ed., 1939, pp. 74-75; Driver, Name That Animal, 1942, p. 346; Stejneger & Barbour, Bull. Mus. Comp. Zool. Harvard Coll. vol. 83, 1943, p. 93; Cowles, Bull. Amer. Mus. Nat. Hist., vol. 83, 1944, pp. 265-296; Smith, Handbook of Lizards, 1946, pp. 289, 308-10; Norris, Copeia, 1949, pp. 176-180; Smith & Taylor, Univ. Kansas Sci. Bull., vol. 33, pt. 2, 1950, p. 355, and Bull. U. S. Nat. Mus. no. 199, 1950, pp. 99-100.

Anota m'callii Stephens, Trans. San Diego Soc. Nat. Hist., vol. 3, 1921, p. 62.

Taxonomic history: Hallowell (1852) described this species as *Anota m'callii*. Girard (1858) placed it in his subgenus *Doliosaurus* in the genus *Phrynosoma*. Cope (1900) again relegated it to the genus *Anota*. Stejneger (1893) dropped Girard's subgenus and used the name *Phrynosoma m'callii*, as have all subsequent writers except Bryant (1911). He pointed out that the supratemporal

fossae of this form were closed by a membranous bony growth and upon such evidence again referred it to *Anota*. Subsequent workers have been prone to disregard Bryant's generic allocation because it was based upon a single specimen.*

Diagnosis: Nostrils within the canthal lines; ventral scales smooth throughout; single row of enlarged gular scales on either side; a mid-dorsal dark line extending from head to base of tail; tympanum concealed; tail flattened.

Description: Head slightly longer than wide, rostrum forming a sharp angle at its union with frontal area; nares within the canthal lines, separated by a distance equal to diameter of nares; frontal scales irregular, those outlining the supraoccular fossae often slightly enlarged; superciliary ridge formed by seven slightly enlarged, pointed scales, and terminating posteriorly in a broad, short spine; occipital spines long and divergent; three temporal spines, last much larger than first; tympanum concealed by scaly integument; rostral slightly enlarged, broader than high and joined laterally by a series of eight or nine supralabials; infralabials inconspicuous, eight or nine in number, separated from chinshields by one or two minute sublabials; eight large serrate chinshields on each side, first two small, remainder subequal in size; single, slightly enlarged row of scales on either side of gular area; a few enlarged, pointed scales on the lateral neck area, these usually arranged in two distinct groups; back covered with small imbricate scales with larger keeled scales dispersed in more or less distinct rows; largest scales forming centers of three pairs of dark spots which parallel the vertebral column. Tail dorsoventrally flattened with two distinct rows of enlarged scales on its upper surface; two small lateral abdominal scale rows, second much smaller than first; a single row of conical scales bordering edge of tail; humerus with several rows of large, imbricate, keeled scales; femur bearing an anterior and a posterior row of slightly enlarged pointed scales; ventral scales smooth throughout; each femoral pore in the center of a single scale; 17-24 pores on each side, the rows separated mesially by from 3-10 preanal scales.

Dorsal ground color an ash-gray, with a distinct dark vertebral line from head to base of tail; several pairs of dark spots over back, each covering a single enlarged scale; several pairs of faint spots on

* Since this paper went to press, Norris and Lowe (Bull. Chicago Acad. Sci., vol. 9, no. 7, 1951, pp. 117-125) have, I believe, conclusively shown that this form should be retained in the genus *Phrynosoma*.

tail uniting into transverse bands toward its end; ventral surface uniform white or cream without dark markings.

Variations: The lateral abdominal scale rows are, in some specimens, reduced to near the size of the surrounding scales. The femoral pores vary from 17-24 on each side with from 3-10 preanal scales separating the rows. The dorsal ground color may vary with the substratum upon which the lizard lives, but in general it will be light cream with the pattern appearing faded. The dark vertebral line may be faded also.

Discussion: The habits of this moderate-sized lizard are not well known. It seems to be mostly, if not entirely, restricted to sandy situations as stated by Klauber (1939) and Norris (1949). Stebbins (1943) discusses the sand adaptations found in this and other lizards. The temperature tolerance has been discussed by Cowles (1939), Cowles and Bogert (1944), and Norris (1949). The active range of these lizards seems to lie between 36 and 37° C (temperatures on surface of sand) with a maximum of 41 to 42° C above which the lizard retreated below the surface of the sand.

The reproductive habits are little known. Norris (*op. cit.*) collected a specimen on 15 May, 1948, which, when dissected, was found to contain seven fully developed eggs. The eggs contained fluid yolk but no detectable embryos.

Distribution: The general distribution of this species is concentrated in the extreme desert areas of southeastern California, the northeastern part of Baja California, the extreme southwestern corner of Arizona and the extreme northwestern part of Sonora. The specimens reported by Klauber from west of Needles, San Bernardino Co., California, were found to be *P. p. calidiarum.*

Locality records: CALIFORNIA. *Imperial Co.:* Benson's Dry Lake, 4 mi. E (LMK 33940); Coyote Mts. (SSNH 13922); Coyote Wells (MVZ 1001); Harpers Well (LMK 23094); Holtville (LMK 1294); Kane Spring (Klauber, 1932); Midway Well (LMK 20174); Plaster City (SSNH 13924), 4 mi. W (LMK 34084); Salton Lake (Sea) (USNM 19095); Salton Park (MVZ 1007, 1019); Seeley (Klauber, 1932); Signal Mt. (LMK 23094); Springers (LMK 28521); Westmoreland (KU 6998). *Riverside Co.:* LaQuinta, 2 mi. E (LMK 23368); Mecca (MVZ 447-450); Palm Springs (LMK 39766, 39765), (MVZ 7063). *San Diego Co.:* Benson's Dry Lake (LMK 22734-38, 22847-48, 23014-15, 23626-30, 23808, 23820-21, 23974-77, 24033-34, 26748, 26888, 26958-59, 27233-37, 27402, 27889, 31621-26, 32990,

33860, 33940), (SSNH 16513-15, 17168); Borrego Valley (LMK 4513, 5810, 33165).

Mexico. *Baja California:* Horseshoe Bend, Colo. River (USNM 15976); Laguna Salada, west side (LMK 32034); Yuha Basin, 3 mi. S United States Border (LMK 7041). *Sonora:* Colorado River, east bank, 5 mi. S United States border (Smith and Taylor, 1950); no specific locality (Bryant, 1911).

Arizona. *Yuma Co.:* Desert of Colo. and Gila River (USNM 162, 4 spec.); Ft. Yuma (USNM 15955); Yuma, 25 mi. W (KU 21930-31), Sandhills E of (CAS 33486-87, 33654), not examined by me.

Phrynosoma modestum Girard

Phrynosoma modestum Girard, *in* Stansbury's Exploration of the Valley of Great Salt Lake Utah, 1852, pp. 361, 365, pl. 6, figs. 4-8; Baird & Girard, Proc. Acad. Nat. Sci. Philadelphia, vol. 6, 1852, p. 69; Hallowell, Sitgreaves' Expedition down the Zuni & Colorado Rivers, 1853, p. 145; Cope, Proc. Acad. Nat. Sci. Philadelphia, 1866, pp. 302-303; Bocourt, Mission Scientifique au Mexique et dans l'Amérique Centrale, Études sur les Reptiles, livr. 4, 1874, p. 232; Cope, Bull. U. S. Nat. Mus. no. 1, 1875, p. 49; Yarrow, Report upon the Geography and Geology Survey West of the 100th Meridian in charge of First Lieut. Geo. M. Wheeler, vol. 5, Zoology, 1875, p. 594; Cope, Proc. Acad. Nat. Sci. Philadelphia, 1883, pp. 10, 12; Yarrow, Bull. U. S. Nat. Mus., no. 24, 1883, pp. 11, 64 (*part.*); Cragin, Bull. Washburn Lab., vol. 1, 1884, p. 6; Gentry, Proc. Acad. Nat. Sci. Philadelphia, 1885, p. 148; Boulenger, Catalogue of the Lizards in the British Museum Natural History, vol. 2, 1885, p. 248; Cope, Proc. Amer. Phil. Soc., vol. 23, 1886, p. 282; Cope, Bull. U. S. Nat. Mus., no. 32, 1887, p. 38; Garman, Bull. Essex Inst., vol. 19, 1887, p. 12; Günther, Biologia Centrali-Americana, Reptiles and Batrachia, 1890, p. 79; Boulenger, Proc. Zool. Soc. London, 1890, p. 78; Cope; Proc. Acad. Nat. Sci. Philadelphia, 1892, p. 335; Van Denburgh, Proc. California Acad. Sci., ser. 2, vol. 6, 1896; p. 342; Cockerell, Amer. Nat. vol. 30, 1896, p. 327; Brown, Proc. Acad. Nat. Sci. Philadelphia, vol. 55, 1903, pp. 546-552; Bailey, N. Amer. Fauna, no. 25, 1905, p. 43; Gadow, Proc. Zool. Soc. London, vol. 194, 1905, p. 213; Ditmars, The Reptile Book, 1907, p. 156; Strecker, Baylor Univ. Bull., vol. 12, no. 1, 1909, p. 13; Ditmars, Reptiles of the World, 1910, p. 151; Gadow, Zool. Jahrb. vol. 29, 1910, p. 706; Stone, Proc. Acad. Nat. Sci. Philadelphia, 1911, p. 229; Bryant, Univ. California Publ. Zool., vol. 9, no. 1, 1911, p. 5; Van Denburgh & Slevin, Proc. California Acad. Sci., ser. 4, vol. 3, 1913, p. 393; Strecker, Baylor Univ. Bull., vol. 18, no. 4, 1915, p. 23; Stejneger & Barbour, Check List of the North American Amphibians and Reptiles, 1917, p. 59; Weese, Amer. Nat. vol. 53, 1919, pp. 33-54; Van Denburgh, Occas. Papers California Acad. Sci., no. 10, vol. 1, 1922, pp. 430-433, pl. 38; Strecker, Sci. Soc. San Antonio, Bull. no. 4, 1922, p. 31; Stejneger & Barbour, Check List of the North American Amphibians and Reptiles, 2 ed. 1923, p. 63; Van Denburgh, Proc. California Acad. Sci., ser. 4, vol. 13, 1924, pp. 191, 210; Burt & Burt, Journ. Washington Acad. Sci., vol. 19, no. 20, 1929, p. 454; Cuesta Terron, Ann. Inst. Biol., vol. 3, 1932, pp. 119-120, fig. 18; Stejneger & Barbour, Check List of the North American Amphibians and Reptiles, 3 ed., 1933, pp. 68-69; Smith, Trans. Kansas Acad. Sci., vol. 37, 1934, pp. 287-289, 290, pl. 11, fig. 3; Burt, Amer. Midl. Nat., vol. 16, 1935, p. 324; Bogert & Oliver, Bull. Amer. Mus. Nat. Hist., vol. 83, 1935, pp. 315, 324; Smith, Univ. Kansas Sci. Bull., vol.

22, 1935, p. 144; Dunn, Proc. Acad. Nat. Sci. Philadelphia, vol. 88, 1936, p. 475; Burt, Trans. Kansas Acad. Sci., vol. 38, 1936, pp. 261, 300, 305; Gloyd, Bull. Chicago Acad. Sci., vol. 5, 1937, p. 113; Little & Keller, Copeia, no. 4, 1937, pp. 219-220; Stejneger & Barbour, Check List of the North American Amphibians and Reptiles, 4 ed. 1939, p. 75; Driver, Name That Animal, 1942, p. 348; Smith & Mittleman, Trans. Kansas Acad. Sci., vol. 46, 1943, p. 245; Marr, Amer. Midland Nat., vol. 32, 1943, p. 482; Stejneger & Barbour, Bull. Mus. Comp. Zool. Harvard Coll. vol. 93, 1943, p. 93; Schmidt & Smith, Zool. Ser. Field Mus. Nat. Hist., vol. 29, 1944, pp. 78, 84; Schmidt & Owens, Zool. Ser. Field Mus. Nat. Hist., vol. 29, 1944, p. 106; Smith & Laufe, Trans. Kansas Acad. Sci., vol. 38, 1945, p. 337; Smith Handbook of Lizards, 1946, pp. 311-313; Maslin, Univ. Colorado Mus. Leaflet, no. 3, 1947, pp. 5, 12; Lowe, Herpetologia, vol. 4, 1947, p. 77; Smith & Taylor, Kansas Sci. Bull. vol. 33, pt. 2, 1950, p. 359; Bull. U. S. Nat. Mus., no. 199, 1950, p. 101.

Doliosaurus modestus Girard, United States Exploring Expeditions of the years 1838, 1839, 1840, 1841, 1842, under the Command of Charles Wilkes USN, vol. 20, Herpetology, 1858, p. 409; Baird, United States Mexican Boundary Survey, under the order of Lieut. Col. W. H. Emory, Reptiles of the Boundary, vol. 2, 1859, p. 10; Baird, Reptiles of the Pacific Rail Road Survey, vol. 10, 1859, p. 38.

Anota modesta Cope, Amer. Nat., vol. 30, 1896, p. 1014; Cope, Report U. S. Nat. Mus. for 1898 (1900), p. 437, fig. 78; Stone & Rehn, Proc. Acad. Nat. Sci. Philadelphia, 1903, p. 32; Ruthven, Bull. Amer. Mus. Nat. Hist., vol. 23, 1907, pp. 550-552; Mearns, Bull. U. S. Nat. Mus., no. 56, 1907, p. 115; Ellis & Henderson, Univ. Colorado Studies, vol. 10, 1913, p. 75.

Phrynosoma platyrhynus Herrick, Terry & Herrick, Bull. Univ. New Mexico, vol. 1, 1899, p. 136, pl. 10, fig. 18.

Taxonomic history: Girard (1852:361) described and named this species from specimens in the United States National Museum taken by Gen. Churchill (No. 163) "from the Rio Grande, west of San Antonio", and by Col. Graham (No. 164, 8 specimens) "from San Antonio to El Paso." Later Girard (1858) divided this genus into four subgenera and relegated this species to his subgenus *Doliosaurus*. Bocourt (1874) also using subgenera placed *modestum* in his subgenus *Phrynosoma*. Cope (1896 and 1900) placed it, along with four other species, in a separate and distinct genus *Anota*, which was characterized by concealed tympana. Subsequent workers, finding the condition of the tympanum in *modestum* varied from complete concealment to complete exposure, chose to disregard Cope's arrangement, using the name *Phrynosoma modestum*.

The type locality, has recently been restricted to Las Cruces, Dona Ana Co., New Mexico, by Smith and Taylor (1950a).

Diagnosis: This small species can be identified by the following characters: absence of the lateral abdominal fringe; moderate development of the dorsal scales, round cylindrical tail; chinshields in contact with the infralabials.

Description: Head as broad as long; rostrofrontal angle abrupt; nostrils moderately large and situated between the canthal lines;

posterior margin of head bearing two occipital and two temporal spines, latter equal to or projecting beyond occipitals; superciliary spine small; chinshields increasing in size posteriorly, penultimate largest, all in contact with infralabials; gular scales small, subequal; one slightly enlarged row in contact with chinshields; tympanum exposed or concealed; neck patches inconspicuous; dorsal scales mainly granular, a few enlarged, keeled scales scattered over back and tail; lateral abdominal fringe absent; ventral scales moderately large and smooth; enlarged postanal scales present in males; seven to thirteen femoral pores on each side, rows separated mesially by as many as five preanal scales; tail reduced abruptly behind base, forming gradually tapering cylinder; lateral fringe absent on tail.

General color light cream appearing bleached; pattern usually apparent and distinctive; ground color varying from light gray to light brown; several dark spots visible on dorsum, most prominent ones on lateral surface of neck; dark groin spots often extending forward to axilla; tail traversed by several dark bands; ventral scales generally without dark spots.

Variation: The degree to which the tympanum is concealed varies greatly among individuals of any given population. In some specimens the tympanum is completely hidden by a scaly integument and in others it is partly exposed and in others it is completely exposed. The tympana on opposite sides of the head of a single individual may differ in concealment to a degree nearly equal to that found in the species as a whole. The number of pores on the ventral surface of each femur varies from minimum of seven to as many as thirteen, the rows being either continuous across the preanal area or separated by a maximum of five scales. The length of the row of pores seems to have no influence on the number of intervening preanal scales; specimens with as many as twelve pores in each row have the rows separated mesially by five preanal scales.

In most specimens the dorsal pattern is faint but in some is greatly darkened. This is especially true of the blotches on the neck and groin. These blotches may meet each other and form dark lateral stripes, which may expand dorsally and approach the vertebral line. The ventral scales are usually void of dark pigment but may possess a random sprinkling of dark flecks.

Discussion: This small, bleached form is not closely related to any other species in the genus. Although not so specialized as

some species, it is certainly unique in the presence of a cylindrical tail and absence of a lateral fringe.

Distribution: The general distribution of this species extends from the central and southern parts of Texas, west through southern New Mexico, and the southeastern part of Arizona, south through the northeastern part of Sonora, most of Chihuahua, southeastward through the northern third of Durango, the northern part of Zacatecas and northeastward through Nuevo León.

Locality records: TEXAS. *Bexar Co.:* San Antonio (Baird and Girard, 1852). *Brewster Co.:* Alpine (USNM 33000); Big Bend area (AMNH 62981); Lone Mt. (USNM 103669); Sanderson, 58 mi. W (MVZ 36713). *Culberson Co.:* Guadalupe Mts. (USNM 32999); Between Guadalupe Mts. and Rio Pecos (USNM 184). *El Paso Co.:* El Paso City (AMNH 15050, 28386, 28649); Ft. Bliss (USNM 83119-20), (AMNH 43287-88); no specific locality (USNM 58182), (KU 15394). *Howard Co.:* Big Springs, 1 mi. E (MVZ 38422), 10 mi. SW (MVZ 38423). *Jeff Davis Co.:* Davis Mts. (USNM 32996). *Llano Co.:* Llano Estacado (USNM 186). *Motley Co.:* Flomot, 3 mi. W (AMNH 67858); Matador, 18 mi. NW (AMNH 67859). *Pecos Co.:* Ft. Stockton (USNM 5176). *Reeves Co.:* Pecos City (USNM 30877); Tayoh (USNM 32997). *Taylor Co.:* Camp Barkley (BYU 6915, 6058-59).

NEW MEXICO. *Bernalillo Co.:* Albuquerque (USNM 37962-4, 32993-5), (AMNH 15197), (KU 11310-14), 10 mi. N (MVZ 33724). *Chaves Co.:* Roswell, 7 mi. E (USNM 93008), 15 mi. W (USNM 32998). *Dona Ana Co.:* Jornada Exp. Range (USNM 100887); Los Cruces (USNM 22320); Rope Springs (USNM 102254). *Eddy Co.:* Carlsbad, 5 mi. N (USNM 93035). *Grant Co.:* Dog Springs (USNM 21014). *Guadalupe Co.:* Between Anton Chico and Cuesta (USNM 174). *Luna Co.:* Silver City, 29 mi. SE (KU 6555). *Otero Co.:* Alamogordo (AMNH 560-66). *Sante Fe Co.:* San Ildefonso (USNM 8511). *Socorro Co.:* Magdelina Mts. (KU 474); San Marcial (Burt, 1935); no specific locality (KU 473). *San Miguel Co.:* no specific locality (Van Denburgh, 1924). *Sierra Co.:* no specific locality (Van Denburgh, 1924).

ARIZONA. *Cochise Co.:* Bowie (USNM 8590); Dos Cabezo (Gloyd, 1937); San Pedro River (USNM 21021).

MEXICO. *Chihuahua:* Ahumada, 11 mi. S (USNM 104687); Chihuahua (city) (USNM 46655), 4 mi. NW (KU 28069); Guzman (Stone, 1911); Júarez (Gadow, 1905); Near Janos (Cope, 1900); Near Progresso Río Santa Maria (USNM 104688-91); Santa Marcia

(USNM 47180-83); Samalayuca, 8 mi. N (AMNH 68432). *Coahuila:* Agua Nueva (Cope, 1900), Álamo de Parros (USNM 177); Allende (Schmidt & Owens, 1944); Buena Vista (Cope, 1900); Cabos (AMNH 68862); Castañuelas (Cope, 1900); Cuatro Ciénegas (Schmidt & Owens, 1944); Hermanas (Schmidt & Owens, 1944); Los Delícias (AMNH 67384), 17 mi. S (AMNH 67383), 5 mi. E (AMNH 67384); Monclova (USNM 67833); Múzquiz

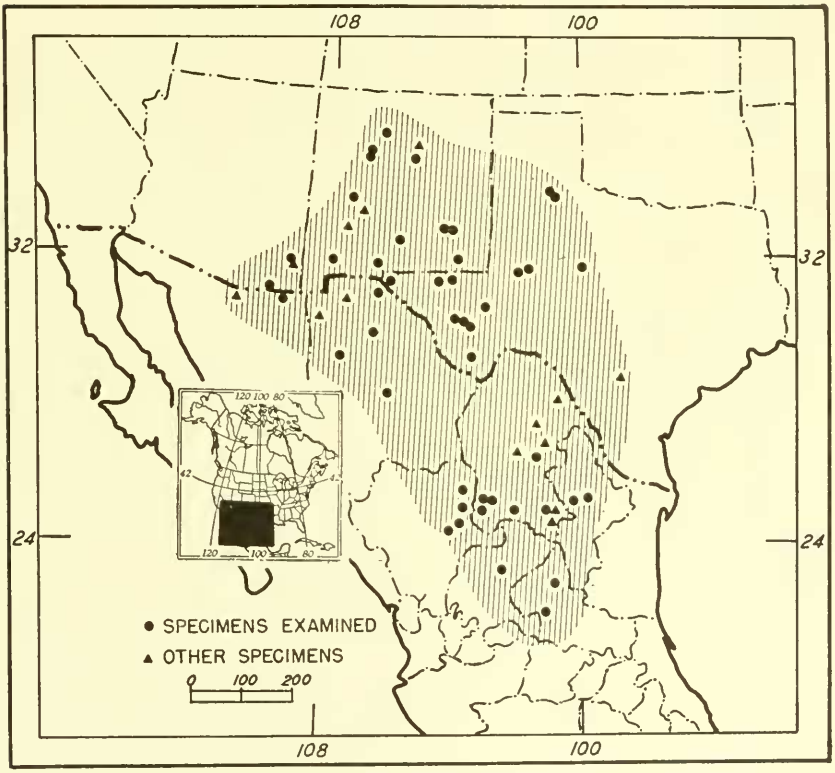


FIG. 4. Map showing the geographic distribution of the species *Phrynosoma modestum.*

(Smith & Mittleman, 1943); Palau (Schmidt & Owens, 1944); Saltillo (Garman, 1887), 1½ mi. W (EHT-HMS 10443); San Pedro (Garman, 1887). *Durango*: Bermejillo, 25 mi. N (KU 19247); La Loma, 7 mi. S (EHT-HMS 10442); Pedriceña (USNM 105313-14); San Juan del Río (AMNH 68340); Between Lerdo and La Goma (USNM 105312). *San Luis Potosí*: Hacienda La Parada (USNM 47211); San Luis Potosí (city), 130 km. N (EHT-HMS 23979, 23968, 23971). *Nuevo León:* Pesquiera Grande (USNM

180, 3 specimens); Santa Caterina (USNM 47837-42). *Sonora*: Los Nogales (Smith & Mittleman, 1943); Nariz Temporal (Mearns, 1907); Sierra de La Nariz (USNM 166-167). *Zacatecas:* La Colorado, 3 mi. W (KU 19246).

Phrynosoma coronatum blainvillii Gray

Phrynosoma blainvillii Gray, Zoology of Beechey's Voyage, 1837, p. 96, pl. 29, fig. 1; Gray, Catalogue of the Species of Lizards in the British Museum (Natural History), 1845, p. 228; Stejneger, N. Amer. Fauna., no. 7, 1893, p. 187; Van Denburgh, Proc. California Acad. Sci. ser. 2, vol. 4, 1895, p. 118; Van Denburgh, Proc. California Acad. Sci., ser. 2, vol. 5, 1896, p. 1005; Van Denburgh, Occas. Papers California Acad. Sci. no. 5, 1897, p. 91; McLain, Critical Notes on a Collection of Reptiles from the West Coast of North America, 1899, p. 8; Meek, Field Columbian Mus., Zool. Ser., vol. 7, 1906, p. 12; Grinnell & Grinnell, Throop Institute Bulletin, no. 35, 1907, p. 26; Grinnell, Univ. California Publ. Zool. vol. 5, 1908, p. 162; Van Denburgh, Proc. California Acad. Sci., ser. 4, vol. 3, 1912, pp. 148-152; Hurter, First Ann. Rep. Laguna Marine Lab. 1912, p. 67; Stejneger & Barbour, Check List of North American Amphibians and Reptiles, 1917, p. 57; Nelson, Mem. Nat. Acad. Sci., vol. 16, 1921, pp. 59, 114.

Phrynosoma coronatum Hallowell, *in* Sitgreaves' Expedition Down Zuni and Colorado Rivers, 1853, p. 122; Lockington, Amer. Naturalist, 1880, p. 295; Yarrow, Bull. U. S. Nat. Mus., no. 24, 1883, p. 70 (*part.*); Gentry, Proc. Acad. Nat. Sci. Philadelphia, 1885, p. 143 (*part.*); Cope, Report U. S. Nat. Mus. for 1898, (1900), p. 430, fig. 76 (*part.*); Meek, Field Columbian Mus., Zool. Ser., vol. 7, 1906, p. 12; Ditmars, The Reptile Book, 1907, p. 152, pls. 46, figs. 12, 16, 49, fig. 2 (*part.*); Bryant, Univ. California Publ. Zool., vol. 9, 1911, p. 18 (*part.*).

Batrachosoma coronatum Girard, United States Exploring Expedition of the Years 1838, 1839, 1840, 1841, 1842, under the Command of Charles Wilkes USN., vol. 20, Herpetology, 1858, p. 400, pl. 20, figs. 10-13; Aug. Duméril & Bocourt, Mission Scientifique au Mexique et dans l'Amérique Centrale, Études sur les Reptiles, livr. 1, 1870, pl. 12, fig. 10; Bocourt, 1874, *idem*, livr. 4, p. 239, (*part.*).

Phrynosoma blainvillei Cope, Bull. U. S. Nat. Mus., no. 1, 1875, p. 49 (*part.*); Cope, Proc. Acad. Nat. Sci. Philadelphia, 1883, pp. 28, 30; Yarrow, Bull. U. S. Nat. Mus., no. 24, 1883, p. 70 (*part.*); Cope, Report U. S. Nat. Mus. for 1898, (1900), p. 423, fig. 74 (*part.*); Stephens, Trans. San Diego Soc. Nat. Hist. vol. 3, no. 4, 1921, p. 62.

Phrynosoma blainvillii blainvillii Bryant, Univ. California Zool. vol. 9, 1911, pp. 5, 19, 29, pl. 4; Atsatt, Univ. California Publ. Zool., vol. 17, 1913, p. 164; Cowles, Journ. Entomol. Zool., Pomona College, vol. 12, 1920, p. 66; Van Denburgh & Slevin, Proc. California Acad. Sci., ser. 4, vol. 11, 1921, pp. 51, 62; Van Denburgh, Occas. Papers California Acad. Sci., no. 10, vol. 1, 1922, pp. 388-395, pl. 32; Stejneger & Barbour, Check List of North American Amphibians and Reptiles, 2 ed., 1923, p. 60; Klauber, Bull. Zool. Soc. San Diego, no. 4, 1928, p. 3 and *idem*, no. 5, 1930, p. 4; Bogert, Bull. Southern California Acad. Sci., vol. 29, 1930, p. 7; Klauber, Copeia, no. 2, 1932, p. 123; Stejneger & Barbour, Check List North American Amphibians and Reptiles, 3 ed., 1933, p. 66; Klauber, Copeia, no. 2, 1936, pp. 103-106; Wood, Copeia, no. 3, 1936, p. 177; Stejneger & Barbour, Check List of North American Amphibians and Reptiles, 4 ed. 1939, p. 72; Smith, Ann. Carnegie Mus., vol. 27, 1939, p. 314; Klauber, Bull. Zool. Soc. San Diego, no. 14, 1939, pp. 93-94; Cowles, Science, NS, vol. 90, 1939, pp. 465-466; Burleson, Copeia, 1942, pp. 246-248; fig. 2 (unnumbered); Driver, Name That Animal, 1942, p. 348; Stejneger & Barbour, Bull. Mus. Comp. Zool. Harvard Coll. vol. 93, 1943, p. 91; Cowles, Bull. Amer. Mus. Nat. Hist., vol. 83, 1944, pp. 265-296.

Phrynosoma coronatum blainvillii Linsdale, Univ. California Publ. Zool., vol. 38, 1932, pp. 349, 368 (*part.*); Burt, Amer. Midl. Nat., vol. 14, 1933, pp. 243-244; Smith & Taylor, Univ. Kansas Sci. Bull., vol. 33, pt. 2, 1950, pp. 357, 375; Bull. U. S. Nat. Mus. no. 199, 1950, p. 103.

Taxonomic history: Blainville's Horned Lizard was described in 1839 by Gray from a specimen collected in "California" by Botta and given to Gray by de Blainville after whom it was named. Its conspecificity with *frontale* was first suspected by Van Denburgh (1897) and was demonstrated by Bryant (1911). Linsdale (1932) recognized only the species *coronatum* reducing *blainvillii* to subspecific status. This met with considerable objection, resulting in the controversy commented upon in the discussion of this form.

Diagnosis: Three or more rows of enlarged gular scales on each side; five posteriorly curved temporal spines; frontal scales large, smooth and rounded.

Description: Head wider than long; frontal area flat; frontal scales large convex and smooth; superciliary ridges distinct, terminating posteriorly in broad, short superciliary spine; occipital shelf bearing four enlarged tubercles; occipital spines large, parallel and curved slightly downward; small interoccipital spine; temporal shelf moderately expanded, bearing five enlarged spines; temporal spines increasing in size posteriorly; terminal spine subequal to occipital spine; nostrils on canthal lines; internasal distance equal to four times diameter of single nostril; supralabials small, inconspicuous; infralabials small, in contact with the chinshields; chinshields five, increasing in size posteriorly; subrictal above line of chinshields, postrictal large, cone-shaped; four rows of enlarged gular scales on each side; outer row largest; two lateral neck patches of enlarged, pointed, soft spines; dorsal scales minute, imbricate and nonkeeled; numerous large, keeled scales scattered over back; two lateral abdominal scale rows, upper row largest, extending from shoulder above arm to groin, lower row limited to central part of abdomen; three large scales on femur; several rows of heavily keeled scales on each humerus; tail with two lateral rows and numerous dorsal, enlarged, keeled scales; ventral scales smooth; femoral pores 15-15.

Dorsal ground color light gray; nuchal blotches large and distinct, dorsal markings moderately wide, irregular bars; five bars traversing tail; frontal area yellowish-tan; temporal and lateral area light gray; venter light tan with light brown spots.

Variation: Being a poorly differentiated form of *coronatum*, this subspecies shows many affinities to *frontale*. The frontal scales are

the only authentic character that will segregate this form from those to the north or south.

Discussion: Two general ideas have been held by recent workers concerning the relationships of the mainland forms of the *coronatum-blainvillii* complex of the horned lizards. The first idea is that *blainvillii* and *coronatum* are distinct species, each with subspecies. The second idea is that there is only one species, *Phrynosoma coronatum,* of which the other forms are subspecies. Linsdale (1932) was the first to suggest that all forms concerned should be considered as subspecies of *P. coronatum,* listing the forms from south to north, as: *P. coronatum coronatum, P. coronatum jamesi, P. coronatum blainvillii* and *P. coronatum frontale.* He considered specimens from northern Baja California as intergrades between *P. c. jamesi* and *P. c. blainvillii.* Klauber (1936) studied these forms, took exception to Linsdale's arrangement, and suggested that two distinct species were involved: The first *P. blainvillii* in which he placed *P. b. blainvillii* and *P. b. frontale* and the second, *P. coronatum* in which he placed *P. c. jamesi* and *P. c. coronatum.* He placed specimens from the upper part of Baja California in a southern population of *P. b. frontale.* Tevis (1944), with additional specimens, supported Linsdale's idea of a single species. The material used by the above three workers plus additional material has been studied by me. The resulting data supports the idea that there is a single mainland species with several subspecies. As Linsdale (*op. cit.*) suggested, a trend of characters exists from *coronatum* through *jamesi* to *blainvillii.* Klauber (*op. cit.*) also observed this trend but noted that specimens of *c. coronatum* differed more from the San Diegan specimens of *P. blainvillii* (= *P. c. blainvillii*) than they did from the more northerly specimens of *P. blainvillii* (= *P. c. frontale*) and therefore thought that the geographic sequence of the trend was discontinuous. This is definitely the case. However, elsewhere (p. 107) in his paper Klauber states, "I therefore conclude that *nelsoni* is invalid and that *P. blainvillii frontale,* which must be the parent form of *blainvillii,* occupies two distinct areas separated by the mildly differentiated race, *P. blainvillii blainvillii.*"

My own study convinces me that the differentiation of *blainvillii* from *frontale* is as Klauber described it but I do not agree with him that two species are involved. If the dispersal onto the peninsula was from the north, as is probable, the parent stock of *blainvillii* (which is *frontale*) should have more characters in common with the Cape form *coronatum* than would its offshoot *blainvillii.* This being the case I, therefore, believe that the data indicate con-

specificity of the two groups rather than the opposite as held by Klauber.

I have found characters to distinguish the northern population of *frontale* from the southern population. (See diagnosis and Table 4.) My arrangement of these forms is as follows:

P. coronatum coronatum, Cape region

P. coronatum jamesi, between lat. 26°20′ and 28°40′

P. coronatum schmidti, between lat. 28°40′ to near 31°50′ and Cedros Island

P. coronatum blainvillii, northern part of Baja California and the southern counties of California

P. coronatum frontale, from southern to central California

P. cerroense, Cedros Island

General Distribution: Southernmost counties of western California and the very northern part of Baja California.

Locality records: California. *Imperial Co.:* no specific locality (Klauber 1934). *Los Angeles Co.:* Azusa, 1 mi N (AMNH 66279); Big Rock Creek (AMNH 68495-97); Claremont, 1½ mi. NW (MVZ 36312); Devils Punch Bowl (Bogert, 1930); Glendale (LMK 4863-64); La Crescenta (Van Denburgh, 1922); Lankershim, 1 mi. E (MVZ 7061); Pasadena (MVZ 852, 2413, 3558, 4799), (AMNH 58974); Placerita Cañon (USNM 54905); (LMK 4428); Rio Los Angeles, Dyke (AMNH 49968-69); San Gabriel Mts. (MVZ 4249), (USNM 44878-79); San Gabriel River, near Azusa (Van Denburgh, 1922); San Pedro (SSNH 14184); Santa Anita, 1½ mi. W (MVZ 25220); Sierra Madre (MVZ 2447, 4254); Valyermo, 1 mi. NW (LMK 40004); no secific locality (USNM 69778-79), (KU 9538-29). *Orange Co.:* Capistrano (USNM 44853), (LMK 31520); Laguna Beach (Van Denburgh, 1922); Santa Ana (Van Denburgh, 1922). *Riverside Co.:* Anza, 2½ mi. E (LMK 23375); Coahuila, 2 mi. W (LMK 23374); Coahuila Indian Reservation (LMK 28694-96); Elsinore (Klauber, 1932); March Field (SSNH 14179); Moreno (SSNH 12103-04); Nuevo, (SSNH 12009); Perris (LMK 2721); Ribbon wood, 2 mi. W (LMK 31519), 7 mi. W (LMK 33307); Temecula (Klauber, 1932). *San Bernardino Co.:* Adelanto, 20 mi. S (LMK 39914), 10 mi. S (LMK 40003); Bush, 6 mi. N (LMK 39903); Cactus Flats (LMK 27328); Cajon Pass (McLain, 1899); Colton, Reche Canyon (MVZ 22, 24, 25, 59, 60); Clark's Ranch (MVZ 858), (LMK 26406); Grapeland (Stanford 1616-14); Hesperia (SSNH 11219-20); Lytle Creek (Van Denbugh, 1922); Ontario (MVZ 31705); Redlands (LMK 23705); San Bernardino, 3 mi. N (MVZ 29381), (USNM 42133), (AMNH 20647-49); San Bernardino Mountains, Pipes Canyon (LMK 39762-

63), Pipee Canyon (LMK 39786); Santa Ana Canyon (MVZ 859); Santa Ana River (MVZ 704), South Fork (MVZ 860); Seven Oaks (MVZ 857); Shandon Hills (MVZ 39567); Sheep Creek (MVZ 39565); Swartout Canyon (Van Denburgh, 1922); Warren's Well (Van Denburgh, 1922); no specific locality (USNM 56863). *San Diego Co.:* Adobe Falls (Burt, 1933); Alpine (SSNH 15570); Ballena (SSNH 13917); Banner (LMK 20953); Barona Ranch (LMK 28623-24); Bonsall (LMK 27258); Boulder Creek (LMK 39392); Boulevard (LMK 26841); Cameron Ranch (USNM 21971); Campo (MVZ 381), (USNM 21973, 21993), (USNM 20483-85); Cuyamaca Lake (LMK 31473), 3 mi. SE (SSNH 18286); Chihuahua Mts. (McLain, 1899); Deerhorn Flats, (LMK 572-573); Dehesa (LMK 29016); Del Dios (LMK 23625, 28485); Dulzura (MVZ 382), Stanford 7919-20, (SSNH 11908); El Cajon (Stanford 7923-24); El Capitan (LMK 21253-54); El Nido (USNM 21965-67); Escondido (SSNH 11909-10, 11992-95); Escondido Reservoir (MVZ 872); Flinn Springs (LMK 1942); Gray's Ranch (USNM 21072); Gulion (MVZ 634); Hodges Dam (LMK 25449); Hot Springs Mts. (SSNH 17570); Jacumba Hot Springs (USNM 21981-91), (LMK 33862), (SSNH 11865), 4 mi. W (LMK 33861); Jamacha (LMK 585); Julian (Van Denburgh, 1922); Kitchen Creek (LMK 39775); Laguna Mountain (LMK 29017, 29079, 31619); Lake Side (USNM 53698-99), (LMK 4344, 27130); La Jolla (MVZ 43485-89), (LMK 25441); La Mesa (USNM 53688-91), (LMK 31233); La Posta (SSNH 13928); Lemon Grove (Stanford 7922); Mesa Grande (Van Denburgh, 1922); Monument 285 (SSNH 13918); Moretti's (LMK 31430); National City (MVZ 43502); Oak Grove (LMK 1848); Ocean Side (USNM 44861); Palm City (LMK 23953); Pine Hills (LMK 35191); Point Loma (SSNH 11216-18); Poway (Klauber 1932); Rainbow (Klauber, 1932); Rincon (LMK 575); Rosedale (Klauber, 1932); Ramona (LMK 27257, 31995), 4 mi. W (LMK 39851); San Diequito Valley (USNM 53694-97); San Diego (MVZ 43480, 43496, 43503), (BYU 8035-37, 8046), (USNM 157, 10779, 13893, 13948, 14587, 14777, 53692-93, 53700-02, 54365, 55105), (LMK 25788, 27409), (SSNH 11309-10, 11695); San Felipe Valley (LMK 8614, 26957, 27407); San Pasqual (LMK 4429); Shady Dell (LMK 7614); Scissor Crossing, 2 mi. W (LMK 31934); State College (LMK 39393); Santa Ysabel (LMK 39391); Sun Crest (LMK 37249), (SSNH 13302); Sutherland (LMK 20877); Tia Juana (USNM 21968-70, 21980); Tubb's Spring (SSNH 13367); Twin Oaks (USNM 16997); Valley

Center (SSNH 27529); Vista (LMK 4343); Warner's Pass (MVZ 1041); Witch Creek (SSNH 11308). *Riverside Co.*: Anza, 4 mi. W (LMK 39776); Banning (USNM 75137-38); Coahuila (=Cahuilla) (LMK 40060); Cabazon (Atsatt, 1913); Eden Hot Springs (LMK 27299); Elsinore (SSNH 13916); Helmet Valley (Van Denburgh, 1897); Keen Camp, 2 mi. W (LMK 25817); Kenworth (Van Denburgh, 1922); Oak Springs (Atsatt, 1913); Perris Valley (Van Denburgh, 1922); Reche Canyon (Van Denburgh, 1922); Riverside (Van Denburgh, 1922); Sage (LMK 10912, 27325); San Jacinto (Van Denburgh 1922); San Jacinto Mts. (USNM 44854); Temescal Mts. (Van Denburgh, 1922); Vallenista (Atsatt, 1913); Val Verde (LMK 23702).

Baja California. Alaska, 15 mi. W (SSNH 16012); Ensenada (Van Denburgh, 1922), 13 mi. S (LMK 23703-04); Laguna Hansen (LMK 27408); Lake Faustina (LMK 31446); Nachoguero Valley (Van Denburgh, 1922); Neji (LMK 23454), 6 mi. N (LMK 23445); Ojos Negros (USNM 37583), (LMK 23445-51, 27400); Pacific Coast, Lower California (USNM 21462); Punta Banda (LMK 26956); San Pedro (LMK 10410); San Rafael Valley, Wassom's Ranch (Van Denburgh, 1922); San Miguel Mission (LMK 23452); San Salado (Meeks, 1905); San Vincente, 3 mi. N (LMK 32128); Tecate (LMK 39063), 10 mi. E (SSNH 16013); Tijuana, 28 mi. S (LMK 38263); Valladeris (MVZ 9777); Valentín, 5 mi. E (LMK 23453).

Phrynosoma coronatum coronatum (Blainville)

Agama (*Phrynosoma*) *coronata* Blainville, Nouv, Ann. Mus. Hist. Nat. Paris, vol. 4, 1835, pp. 52-54, pl. 25, figs. 1a-c.

Phrynosoma coronatum Aug. Duméril & Bibron, Érpetologie Générale, vol. 4, p. 318; Duméril & Duméril, Catalogue Méthodique Collection Reptiles du Muséum d'Histoire Naturelle de Paris, 1851, pp. 78-80; Aug. Duméril & Bocourt, Mission Scientifique au Mexique et dans l'Amerique Centrale, Études sur les Reptiles, livr. 1, 1870, pl. 12, fig. 10; Bocourt, *idem*, livr. 4, 1874, p. 239 (*part.*); Cope Proc. Acad. Nat. Sci. Philadelphia, 1866, p. 312; Cope, Bull. U. S. Nat. Mus., no. 1, 1875, pp. 50, 93; Yarrow, Bull. U. S. Nat. Mus., no. 24, 1883, p. 39; Stejneger, N. Amer. Fauna, no. 7, 1893, p. 187; Van Denburgh, Proc. California Acad. Sci., ser. 2, vol. 4, 1894, p. 296; Van Denburgh, Proc. California Acad. Sci., ser. 2, vol. 5, 1895, p. 115; Cope, Rept. U. S. Nat. Mus. for 1898 (1900), p. 430 (*part.*); McLain, Contributions to the Neotropical Herpetology, 1899, p. 2; Mocquard, Nouv. Arch. Mus. Hist. Nat. Paris, ser. 4, vol. 1, 1899, p. 314; Ditmars, Reptiles of the World, 1910, pp. 151-153 (*part.*); Bryant, Univ. California Publ. Zool., vol. 9, 1911, p. 5; Stejneger & Barbour, Check List North American Amphibians and Reptiles, 1917, p. 58; Van Denburgh & Slevin, Proc. California Acad. Sci., vol. 11, 1921, pp. 51, 62; Nelson, Mem. Nat. Acad. Sci., vol. 16, 1922, pp. 114, 115; Cuesta Terron, Mem. Y. Rev. Soc. Cient. Antonio Atzate, vol. 39, 1921, pp. 165-166; Van Denburgh, Occas. Papers. California Acad. Sci., no. 10, vol. 1, 1922, pp. 403-406; Stejneger & Barbour,

Check List of North American Amphibians and Reptiles, 2 ed., 1923, p. 61; Stejneger & Barbour, Check List of North American Amphibians and Reptiles, 3 ed., 1933, p. 67.

Phrynosoma (*Batrachosoma*) *coronatum* Fitzinger, Systema Reptilium, 1843, p. 79.

Phrynosoma cornutum Yarrow, Bull. U. S. Nat. Mus., no. 24, 1883, pp. 66-67 (*part.*); Belding, West Amer. Scientist, vol. 3, 1887, p. 98; Stejneger, N. Amer. Fauna, no. 7, 1893, pl. 2 figs. 1a-c.

Phrynosoma asio Yarrow, Bull. U. S. Nat. Mus., no. 24, 1883, p. 67; Boulenger, Catalogue of the Lizards in the British Museum (Natural History), vol. 2, 1885, p. 244, (*part.*); Belding, West Amer. Scientist, vol. 3, 1887, p. 98.

Phrynosoma coronatum coronatum Linsdale, Univ. California Publ. Zool., vol. 38, 1932, pp. 367-68; Klauber, Copeia, 1936, pp. 106-110; Stejneger & Barbour, Check List of North American Amphibians and Reptiles, 1939, p. 73; Stejneger & Barbour, Bull. Mus. Comp. Zool. Harvard Coll., vol. 93, 1943, p. 92; Tevis, Copeia, 1944, pp. 13-18; Smith & Taylor, Univ. Kansas Sci. Bull. vol. 33, pt. 2, 1950, pp. 322, 375; Bull. U. S. Nat. Mus. no. 199, 1950, p. 102.

Taxonomic history: This form first named by de Blainville (1835: 52) from specimens collected by Botta in "California" was thought to occur throughout Baja California. The subsequent naming of new forms from the central and northern parts of the peninsula have restricted *coronatum* to the Cape region.

Diagnosis: This species from the lower part of Baja California can be distinguished by: three or more rows enlarged gular scales on each side; postrictal scale reduced or absent; frontal scales platelike, rugose and light edged.

Description: Head slightly longer than wide; frontal area flattened and covered with large platelike, light-edged scales; superciliary ridges prominent, composed of six unequal scales, the last being the large, triangular superciliary spine; nostrils on, or slightly within, the canthal lines; nostrils separated mesially by one large and two small scales, distance equal to approximately two times diameter of nostril; occipital spines large, grooved and divergent, interoccipital spine prominent; series of enlarged tubercles on occipital shelf at base of occipital spine; temporal shelf moderately developed, bearing four enlarged spines; temporal spines large, increasing in size posteriorly and directed outward (not sloping to the rear); first temporal spine directly below eye, second, third and fourth equally spaced between first and occipital spine; tympanum exposed; labials small, seven in number, infralabials 10-11, in contact with chinshields anteriorly, separated from them posteriorly by one sublabial; chinshields 5-5, increasing in size posteriorly, penultimate largest; subrictal slightly above chinshield row, slightly overlapping fifth chinshield; postrictal small, in line with subrictal; five rows enlarged gular scales of each side of throat; outer row largest;

two lateral neck patches of enlarged spines, lower patch containing largest spines; back covered with small, imbricate, smooth scales interspersed with numerous, large, keeled spines; large spines arranged in three indistinct longitudinal rows on each side, converging into a single paired row on base of tail; two lateral abdominal rows; upper row with much larger spines, extending from above arm insertion to groin; lower row of much smaller spines extending approximately from a point one centimeter behind insertion of arm to a point about one and one-half centimeters in front of insertion of leg; tail with single lateral row; upper and lower leg with several enlarged spines; upper arms bordered anteriorly by two short rows of enlarged scales; ventral abdominal scales smooth, imbricate; postanal area usually with several enlarged scales in males; short series of enlarged spinelike scales lateral to vent; femoral pores 15-17; rows separated mesially by six preanal scales.

Dorsal ground color tan, nuchal blotches reduced to narrow black bands extending from below bases of the occipital spines, (curving caudolaterally) onto shoulder; dorsal blotches reduced to narrow, irregular dark markings; lateral areas darker; frontal area black with narrow reticular light marking on edges of plates; temporal and lateral areas light brown; occipital area mixed black and tan; occipital spines striated; tail with several indistinct slightly darkened bands; venter light tan with few scattered darkened blotches.

Variations: The head usually is longer than wide, being the reverse in only one out of twenty specimens, with three being equally as wide as long. The postrictal scale is completely absent in some specimens but is moderately developed in others. In three specimens from Todos Santos, two have the postrictals only slightly developed, being about one fifth to one fourth the length of the subrictal; in the third the postrictal is much larger being about one half as long as the subrictal. The more northern specimens have a tendency for longer and larger postrictal scales. The subrictal scale varies in position from directly in line with the chinshields to slightly above them. The latter condition is more noticeable in the northern specimens of this subspecies.

The dorsal ground color varies from light gray into medium brown depending upon the substratum. The nuchal blotches may be so large as to cover the major part of the neck area or be reduced to narrow curving bands on the neck and shoulders. The dorsal pattern is generally reduced appearing as narrow irregular bands; however the degree of reduction is not constant.

The femoral pores may be from 14 to 24 on a side with from two to seven preanal scales separating the rows. The ventral scales are smooth with light keeling on those of the chest area.

Discussion: See *P. c. blainvillii.*

General distribution: This form is found in the lower one-fourth of the Peninsula of Baja California, over its entire width.

Locality records: MEXICO. *Baja California:* Cape St. Lucas (USNM 69490, 11538, 11 spec.), (SSNH 17663), (LMK 10778-80, 20521-26), 4 mi. E (LMK 30230); Carnicobra (MVZ 13628); Eureka (MVZ 11741-67); La Paz (USNM 37586-90), 14 mi. SW (17661-62); Medano Armarillo, Magdelina Bay (USNM 13631); Miraflores (AMNH 5499, 5701), (MVZ 13634); Refugio (MVZ 13630), 9 mi. S (LMK 30233); San José del Cabo (KU 2996, 3000), (MVZ 9587, 9779), (SSNH 17664), (USNM 46888, 64465), 15 leagues N (USNM 60401); Santo Domingo (MVZ 13620); Todos Santos (MVZ 11734-39), 7 mi. S (LMK 30232), 15 mi. N (LMK 30231); Triunfo (MVZ 13632); Valle Dares (MVZ 9777); no specific locality (MVZ 13635-36), (USNM 58880).

Phrynosoma coronatum frontale Van Denburgh

Phrynosoma coronata Holbrook, North American Herpetology, 1 ed., vol. 3, 1838, p. 65, pl. 11, and *idem.* 2 ed., vol. 2, 1842, p. 97, pl. 13.

Phrynosoma coronatum Girard, in Stansbury's Expedition to the Valley of the Great Salt Lake of Utah, 1852, p. 36, pl. 7, figs. 7-12; Yarrow & Henshaw, Annual Report to the Chief of Engineers for 1878, Survey West of the 100th Meridian, app. NN. 1878, p. 225; Yarrow, Bull. U. S. Nat. Mus., no. 24, 1883, p. 70, (*part.*); Gentry, Proc. Acad. Sci. Philadelphia, 1885, p. 143 (*part.*); Townsend, Proc. U. S. Nat. Mus., vol. 10, 1887, p. 238 (*part.*); Fitch, Amer. Midl. Nat., vol. 41, 1949, p. 516.

Tapaya coronata Cooper, Proc. California Acad. Sci., vol. 4 1870, p. 64.

Phrynosoma blainvillei Cope, Bull. U. S. Nat. Mus., no. 1, 1875, p. 49 (*part.*); Yarrow, Bull. U. S. Nat. Mus., no. 24, 1883, p. 70 (*part.*); Cope, Report U. S. Nat. Mus. for 1898, (1900), p. 423 (*part.*); Ditmars, The Reptile Book, 1907, p. 152 (*part.*).

Phrynosoma blainvillii Stejneger, N. Amer. Fauna, no. 7, 1893, p. 187, pl. 2, fig. 2.

Phrynosoma frontalis Van Denburgh, Proc. California Acad. Sci., ser. 2, vol. 4, 1894, p. 296.

Phrynosoma frontale Van Denburgh, Occas. Papers California Acad. Sci., no. 5, 1897, p. 93; McLain, Critical Notes on a Collection of Reptiles from the Western Coast of North America, 1899, p. 8; Meek, Field Columbian Mus., Zool. Ser., vol. 7, no. 1, 1906, p. 12; Stone, Proc. Acad. Nat. Sci. Philadelphia, 1911, p. 229; Stejneger & Barbour, Check List of North American Amphibians and Reptiles, 1917, p. 59.

Phrynosoma blainvillii frontale Van Denburgh, Occas. Papers California Acad. Sci., no. 5, 1897, p. 95; Bryant, Univ. California Publ. Zool., vol. 9, 1911, pp. 5, 38, pl. 5; Van Denburgh, Proc. California Acad. Sci., ser. 4, vol. 3, 1912, p. 148; Grinnell & Camp, Univ. California Publ. Zool., vol. 17, 1917, p. 165; Van Denburgh, Occas. Papers California Acad. Sci., no. 10, vol. 1, 1922, pp. 385-401, pl. 33; Stejneger & Barbour, Check List of North American Amphibians and Reptiles, 2 ed. 1923, p. 60; Burt, Jour. Washington Acad.

Sci., vol. 19, 1929, pp. 453-454; Bogert, Bull. So. California Acad. Sci., vol. 29, 1930, p. 7; Stejneger & Barbour, Check List of North American Amphibians and Reptiles, 3 ed., 1933, p. 66; Klauber, Copeia, 1936, pp. 103-110 (*part.*); Stejneger & Barbour, Check List of North American Amphibians and Reptiles, 4 ed., 1939, p. 72; Cowles, Science, NS, vol. 90, 1939, pp. 465-466; Stejneger & Barbour, Bull. Mus. Comp. Zool. Harvard Coll., vol. 93, 1943, p. 91 (*part.*).

Phrynosoma coronatum frontale Linsdale, Univ. California Publ. Zool., vol. 38, 1932, p. 367; Smith & Taylor, Univ. Kansas Sci. Bull., vol. 33, pt. 2, 1950, pp. 356, 375; Bull. U. S. Nat. Mus. no. 199, 1950, p. 103.

Taxonomic history: Van Denburgh (1894) recognized the distinctiveness of this form and described it as a full species from a specimen in the Stanford University Collection taken by Gilbert and Price in Bear Valley San Benito County, California. Van Denburgh later (1897) found specimens that appeared to show intergradation with *blainvillii* and suggested that if this were the case, it should be given subspecific rank under *blainvillii*. Bryant (1911) adequately demonstrated the intergradation.

Diagnosis: Three or more rows enlarged gular scales on each side; postrictal spine large; five closely set temporal spines gradually increasing in size posteriorly; frontal scales small, often pointed and rugose.

Description: Head broader than long; frontal area slightly concave, covered with small, often pointed, rugose scales; superciliary ridge not prominent; nostrils on canthal line; internasal distance equal to three and one-half or four times nostril diameter; occipital shelf with four enlarged erect tubercles; occipital spines long, separated mesially by a distance equal to basal diameter; interoccipital spine moderately large; temporal shelf moderately expanded, bearing five enlarged pointed spines; temporal spines closely set, curved posteriorly, largest subequal to occipital spine; supralabials small, inconspicuous; infralabials small, in contact with chinshields anteriorly separated posteriorly by three minute sublabials; chinshields increasing in size posteriorly; subrictal completely above line of chinshields; postrictal long and slender, on line of chinshields; three rows of enlarged gular scales on each side; two lateral neck patches, lower one most prominent; dorsal scales minute, smooth, imbricate; numerous large keeled scales dispersed over back; two rows of enlarged, spinelike scales in lateral abdominal fringe, upper row largest and most extensive; vertebral line covered with medium, imbricate, keeled scales; several indistinct rows of spines on tail; ventral scales small, imbricate and smooth; femoral pores 14-14 with four preanal scales separating the rows mesially.

Dorsal ground color gray; nuchal blotches dark brown to black; dorsal pattern of three pairs of irregular bars edged posteriorly in light buff; tail with several indistinct transverse bars; head olive; frontal scales stippled with brown; ventral scales cream with numerous irregular dark brown bars.

Variation: The width of the head is equal to, or exceeds, its length by as much as 17 percent in all but two of the specimens measured in this study. The fourth temporal spine (counting from rear forward) may be reduced in size or entirely absent.

Discussion: See *P. c. blainvillii.*

Distribution: Central California west of the Sierra Nevadas, south into southern Ventura, northern Los Angeles, and western San Bernardino counties.

Locality records: CALIFORNIA. *Alameda Co.*: Berkeley (MVZ 2291, 11030, 12734, 17147, 17985); 7 mi. SE (MVZ 38945, 38976); Livermore 9 mi. SE (MVZ 36298). *Calaveras Co.*: Mokelumne Hill (Van Denburgh, 1922). *Contra Costa Co.*: Antioch (MVZ 43826-27); Brentwood (MVZ 12263); Mt. Diablo (MVZ 24126), west side of (MVZ 3954), Castle Rock Park (MVZ 33623); Rock City (MVZ 33627); Skeleton Tree (MVZ 33626). *El Dorado Co.*: Placerville (Van Denburgh, 1922); no specific locality (USNM 160). *Fresno Co.*: Fresno (USNM 11760,, 11793, 12568, 18453-55, 45137); Mendota (USNM 34613-14, 34616-20). *Kern Co.*: Asphalto (Van Denburgh, 1922); Bakersfield (USNM 18456), west of (SSNH 11176); Bodfish (Van Denburgh, 1922); Brechenridge (Van Denburgh, 1922); Button Willow (Van Denburgh, 1922); Canada de los Uvas (USNM 18460); Carrizo Plains (USNM 18457-58); Chimney Rock (Van Denburgh, 1922); Cuddy Valley (LMK 2850); Dow (LMK 2715-16); Fort Tejon (USNM 4587, 10 spec., 4588, 10 spec., 18459, 32335); Kern River, S. Fork (USNM 10784, 16440, 18450); Kern Valley (Van Denburgh, 1922); Kernville (USNM 18451-52); Maricopa (LMK 8810); McKittrick, 3 mi. N (SSNH 16052); Ft. Pinos (LMK 5182-84); Onyx (Van Denburgh, 1922); Rose Station (Van Denburgh, 1922); San Emidio Plains (Van Denburgh, 1922); Tehachapi Mountains (Van Denburgh, 1922); Walker Basin (USNM 18449); Walker Pass (USNM 18446-48); Weldon (Van Denburgh, 1922); Wheeler Ridge Road (Van Denburgh, 1922). *Kings Co.*: Lemoore (Van Denburgh, 1922). *Los Angeles Co.*: Alhambra (USNM 17404-07); Antelope Valley, Elizabeth Lake (Van Denburgh, 1922); Burbank (USNM 45135); Mescal Gulch (LMK 2720); Neenach, 5 mi. S (Grinnell

& Camp, 1917); Placerita Cañon (USNM 54842), (LMK 4370-71); San Francesquito Canyon (LMK 2717); Tujunga Canyon (Grinnell & Camp, 1917); Tujungan Wash (LMK 2719); no specific locality (USNM 13949, 2 spec.). *Madera Co.*: Madera (MVZ 42710), 5 mi. S (Van Denburgh, 1922); San Joaquin Experiment Range (Fitch, 1949). *Mariposa Co.*: Coulterville, 5 mi. NE (Grinnell & Camp, 1917). *Merced Co.*: Caldwell (USNM 5433); Gadwall (Van Denburgh, 1922); Livingstone (LMK 38173-74), (Stanford 3614), 4-5 mi. W (LMK 38079-80); Los Banos, 22 mi. S (USNM 2541, 2543-44), (Stanford 3697). *Monterey Co.*: Abbot's Ranch (Van Denburgh, 1922); Arroyo Seco (Van Denburgh, 1922); Carmel, 9 mi. E (MVZ 38616), Valley (Stanford 3325); Del Monte (MVZ 9321), (USNM 44603-04); King City (SSNH 11175), 9 mi. NE (LMK 27528), 24 mi. W (AMNH 37218); Metz (Van Denburgh, 1922); Monterey (USNM 156, 7908); Nottley's Landing, 10 mi. E (MVZ 16699-700); Pacific Grove (Van Denburgh, 1922); Sea Side (USNM 44601-02); Soledad, 5½ mi. ENE (MVZ 39075-76); Tassajara Creek (USNM 46809-10); Watsonville, 7 mi. S (MVZ 6327-28). *Placer Co.*: Auburn (Van Denburgh, 1922); Forest Hill (Van Denburgh, 1922); *Sacramento Co.*: American River, near Folsom (LMK 25836); Fair Oaks (LMK 25835); Roseville (LMK 27329); Sacramento (LMK 25834, 27294-95). *San Benito Co.*: Bear Valley (Stanford Mus. 93 type); Hernandez, 4 mi. S (MVZ 21355); Pinnicales Post Office, 4 mi. NW (MVZ 36189), 4 mi. W (MVZ 36190); San Benito (MVZ 21356); San Juan (Van Denburgh, 1922). *San Francisco Co.*: San Francisco (USNM 8862). *San Joaquin Co.*: Alameda Co. line, ½ mi. E (MVZ 33701); Lathrop (MVZ 3551-52, 3555, 3568-69, 3572, 3797, 4799, 4803); Ripon (MVZ 7188), (Stanford 3327); Stockton (LMK 25999); Tracy (Grinnell & Camp, 1912). *San Luis Obispo Co.*: Edna (Van Denburgh, 1922); San Juan River, S of Shandon (Van Denburgh, 1922); Shandon (Van Denburgh, 1922); Simmler, 5 mi. S (SSNH 16038-44); Temblor Mountain (Van Denburgh, 1922). *San Mateo Co.*: Searsville, (Van Denburgh, 1897). *Santa Barbara Co.*: Big Pine (MVZ 34627); Bluff Camp (MVZ 35292, 35339-41); Cuyama Valley (USNM 48729, 59839-42); San Marcos Grade, Summit (LMK 20765-66); Santa Barbara (USNM 8648, 10780), 8 mi. NE (MVZ 35291, 35342-43, 43626), (LMK 37710, 38688). *Santa Clara Co.*: Canada Valley (Van Denburgh, 1897); Congress Springs (Van Denburgh, 1922); Coyote Creek (Van Denburgh 1897); Gilroy (Van Denburgh, 1922); Livermore, 40 mi. SE (MVZ 36425); Los Gatos (Van Denburgh, 1922); Lyndon

(Van Denburgh, 1922); Mayfield (Van Denburgh, 1897); Morganhill (Van Denburgh, 1897); Mt. Hamilton (USNM 53599); Mountain View (Van Denburgh, 1922); Santa Clara (Van Denburgh, 1897); Smith Creek (Stanford 3324); Stanford (Van Denburgh, 1922); Wrights (Van Denburgh, 1897). *Santa Cruz Co.*: Watsonville (Van Denburgh, 1922). *Shasta Co.*: Kenneth (LMK 25837). *Sonoma Co.*: Bodega (USNM 154). *Tulare Co.*: Earlimart (Van Denburgh, 1922); Goshen (Van Denburgh, 1922); Pixley (LMK 23971); Tipton (USNM 45136); Tulare Lake, W side (USNM 44807); Visalia (LMK 20924). *Ventura Co.*: Lockwood Valley (LMK 2718); Matilija (Van Denburgh, 1922); Mount Pinos (Van Denburgh, 1922); Montalva (Van Denburgh, 1922); Nordhoff (Van Denburgh, 1922); Sespe Creek (AMNH 44340, 44361).

Phrynosoma coronatum jamesi Schmidt

Phrynosoma jamesi Schmidt, Bull. Amer. Mus. Nat. Hist., vol. 46, 1922, pp. 668-669, pls. 55, 56; Stejneger & Barbour, Check List of North American Amphibians and Reptiles, 2 ed., 1923, p. 62; Stejneger & Barbour, Check List of North American Amphibians and Reptiles, 3 ed., 1933, p. 68.

Phrynosoma coronatum jamesi Linsdale, Univ. California Publ. Zool., vol. 38, 1932, pp. 349, 369; Klauber, Copeia, no. 2, 1936, pp. 103-110; Stejneger & Barbour, Check List of North American Amphibians and Reptiles, 4 ed., 1939, p. 73; Stejneger & Barbour, Bull. Mus. Comp. Zool. Harvard Coll., vol. 93, 1943, p. 93; Tevis, Copeia, no. 1, 1944, pp. 13-18; Smith & Taylor, Univ. Kansas Sci. Bull., vol. 33, pt. 2, 1950, pp. 321, 375; Bull. U. S. Nat. Mus., no. 199, pp. 102-103.

Taxonomic history: This form of central Baja California was named by Schmidt (1922:668) from a specimen collected at San Bartolomé Bay by H. Townsend. It was reduced to subspecific status by Linsdale (1932) where it has since remained.

Diagnosis: Three or more rows of enlarged gular scales on each side of throat; four enlarged temporal spines on each side of head, fourth from rear reduced leaving a gap in the continuity; postrictal present and moderately developed; subrictal slightly above the row of chinshields; five chinshields on each side.

Description: Head slightly longer than wide; frontal area flattened, covered with dark platelike scales bordered in light color; nostrils large, on the canthal line; occipital horns large, slightly divergent; interoccipital spine moderately developed; four temporal spines on each side; bases of two center temporal spines in contact; temporal shelf slightly developed; occipital shelf with several enlarged tubercular scales; superciliary ridge inconspicuous, terminating posteriorly in slightly enlarged triangular spine; tympanum exposed; labials small, inconspicuous; infralabials small, in contact

with chinshields; chinshields five on each side, increasing in size posteriorly; subrictal slightly above level of chinshields; postrictal scale moderately long and thin; four rows or enlarged gular scales on each side; two lateral neck patches; back covered with small, imbricate, smooth scales interspersed with enlarged, keeled scales; enlarged scales forming three pair of indistinct longitudinal rows; rows converging on tail base to a single pair; two rows enlarged lateral spines, lower pair greatly reduced; ventral scales smooth; femoral pores 17-17, rows separated mesially by four preanal scales.

Dorsal ground color grayish; nuchal blotches distinct; dorsal blotches reduced to narrow irregular bands; bands edged posteriorly in lighter color; several indistinct dark bands on tail; frontal area dark; light scale edges forming reticulate pattern; temporal and lateral areas tan; ventral area light with few scattered dark spots.

Variation: The size and pattern of the frontal scales varies from the large, dark scales prevalent in *coronatum* to a much reduced, slightly rugose scale approaching the condition found in *schmidti.* The postrictal is always present but varies in size and distinctness. In the above two characters the trend is, in general geographically consistent, changing gradually from south to north. The temporal spines vary in number and arrangement. Four is the usual number; however, a fifth may appear between the third and fourth becoming, in some specimens, larger than the fourth. The spines may project laterally or be angled posteriorly. From 14 to 20 femoral pores are present with from one to seven preanal scales separating the rows mesially.

Discussion: Specimens from Barril and San Francisquito Bay appear distinct and may be found to be a new form when others are available.

General distribution: Central part of Baja California approximately between the latitudes of 26°20′ and 28°40′.

Locality records: Mexico: *Baja California:* Abreojos Pt. (LMK 38927, 40077-78), 35 mi. E (LMK 38945); Ballenas Bay (LMK 38939); Barril (SSNH 18082-84); Calmalli, 3 mi. W (MVZ 13625); El Arco (SSNH 18087), 14 mi. SE (MVZ 37333); Loreto (LMK 30234, 30236-41); Los Ángeles Bay (LMK 39003); Miller's Landing, 1 mi. SSE (MVZ 37331), 5 mi. ESE (MVZ 37332); Mulege (Van Denburgh, 1922); San Augustin, 2 mi. E (SSNH 18091); San Bartolmé Bay (USNM 64450), (AMNH 5497); San Francisquito Bay (SSNH 18085); San Ignacio (MVZ 10659-60, 13637-40), 20 mi. N

(MVZ 13626-27); Santa Rosalia (Van Denburgh, 1922); Punta San Jacinto, plains north of (SSNH 18520); between and Punta Camalu (SSNH 18517).

Phrynosoma coronatum schmidti Barbour

Phrynosoma coronatum Meek, (*nec.* Blainville), Field Columbian Mus., Publ. Zool. vol. 7, 1905, p. 12; Van Denburgh, Occas. Papers California Acad. Sci., no. 10, vol. 1, 1922, pp. 403-406 (*part.*).

Phrynosoma schmidti Barbour, Proc. New England Zool. Club., vol. 7, 1921, p. 113; Stejneger and Barbour, Check List of North American Amphibians and Reptiles, 2 ed., 1923, p. 63, 3 ed., 1933, p. 69 and 4 ed., 1939, p. 75, and Bull. Mus. Comp. Zool. Harvard Coll., vol. 93, 1943, p. 95.

Phrynosoma nelsoni Schmidt, Bull. Amer. Mus. Nat. Hist., vol. 46, 1922, pp. 666-668, pl. 54, fig. 3; Stejneger & Barbour, Check List of North American Amphibians and Reptiles, 2 ed., 1923, p. 63; Stejneger & Barbour, *idem*, 3 ed., 1933, p. 69.

Phrynosoma coronatum blainvillii Linsdale, Univ. California Publ. Zool., vol. 38, 1932, pp. 349, 368 (*part.*).

Phrynosoma ochoterenai Cuesta Terron, Anal. Inst. Biol., vol. 3, 1932, p. 109.

Phrynosoma blainvillii frontale Klauber, Copeia, 1936, pp. 103-110 (*part.*); Stejneger & Barbour, Bull. Mus. Comp. Zool. Harvard Coll., vol. 93, 1943, p. 91 (*part.*); Tevis, Copeia, 1944, pp. 13-18; Smith & Taylor, Univ. Kansas Sci. Bull., vol. 33, 1950, pp. 323, 375; Bull. U. S. Nat. Mus., no. 199, 1950, p. 103.

Diagnosis: Three rows enlarged gular scales on each side; three posterior temporal spines, significantly enlarged, and directed laterally; head slightly longer than wide; frontal scales small, pointed, rugose, without dark pigment; subrictal scale distinctly above row of chinshields.

Description: Head slightly longer than wide; frontal area flat, covered by small, rugose scales; rostrofrontal angle obtuse; nostrils above canthal line, separated by distance equal to three times diameter of one nostril; superciliary ridge distinct, terminating posteriorly in blunt triangular spine; occipital shelf bearing four medium-sized tubercles; interoccipital spine small; occipital spines well developed; interoccipital distance equal to basal diameter of one spine; temporal area moderately developed, bearing five enlarged laterally projecting spines; three posterior showing marked enlargement; supralabials and infralabials inconspicuous; chinshields in contact with infralabials throughout; subrictal scale distinctly above row of chinshields; postrictal of medium size; three enlarged rows of gular scales on each side; tympanum exposed; dorsal scales small, imbricate, smooth; eight indistinct longitudinal rows of enlarged, keeled scales, four of which continue onto base of tail; two rows of enlarged flexible spines in lateral abdominal fringe, upper row largest; two short rows of enlarged scales on femur; two rows of enlarged, pointed, imbricate, keeled scales on humerus; ventral scales

smooth throughout; femoral pores 16-17, rows separated mesially by five preanal scales.

Dorsal ground color light gray, nuchal spots dark brown; four equally spaced, incomplete, irregular, dark brown bars between nuchal spots and rump; tail with six transverse bars; head olive; larger spines with dark striations; ventral scales cream with reticulate black markings.

Variation: The frontal scales vary from the small, convex rugose condition found on the specimens from near San Quintín to larger, smoother condition northward, intergrading with *blainvillii* and southward becoming larger, flatter and darker. The temporal spines are distinct from each other in *schmidti,* giving the head a more jagged appearance. The fourth spine is typically reduced and is often found in a position slightly above the remaining row in which case the bases of the third and fifth scales may be in contact. However, specimens can be found in the northern localities that has this spine in place in the row and of expected size.

The ground color, as expected changes with the substratum and may vary from ivory, through the tans and browns to a dull gray. The pattern is generally distinguishable and may vary in color from brown to black. A few dark flecks may be found on the frontal scales in the more southern specimen.

Discussion: The name *Phrynosoma schmidti* Barbour antedates *Phrynosoma nelsoni* Schmidt and therefore must be used if the specimens from Cedros Island are to be included in this subspecies. The specimen from Punta Prieta and vicinity approach an intermediate stage between *schmidti* and *jamesi.* However, the majority of their characters seem to be slightly nearer those of the typical *schmidti,* thus justifying their placement here.

General distribution: This subspecies ranges generally between Lat. 28°50′ to near 31°50′. The northern distribution is confined to the area west of the Sierra Juarez and the Sierra San Pedro Mártir.

Locality records: Mexico. *Baja California:* Aguajeta, 10 mi. S (SSNH 16719), 15 mi. S (SSNH 16720); Arroyo Medano Crossing (between Arroyo San Miguel Lat. 31° 51′ and Pt. Descanso Lat. 32°15′), 4 mi. N (LMK 38380); Catavina Lat. 29°49′, 19 mi. N (LMK 40411-12); El Marmol Lat. 29°37′ (LMK 39216); Ensenda Lat. 31°52′, 17 mi. N (LMK 40415); Hamilton Ranch, somewhere between Lats. 30°30′ and 31°30′ (LMK 39036), 10 mi. N (LMK 38944), 37 mi. S (SSNH 16718), 43 mi. S (SSNH 16716-17); La Grulla Lat. 30°56′ San Pedro Mártir Mountains 10 mi. W (LMK

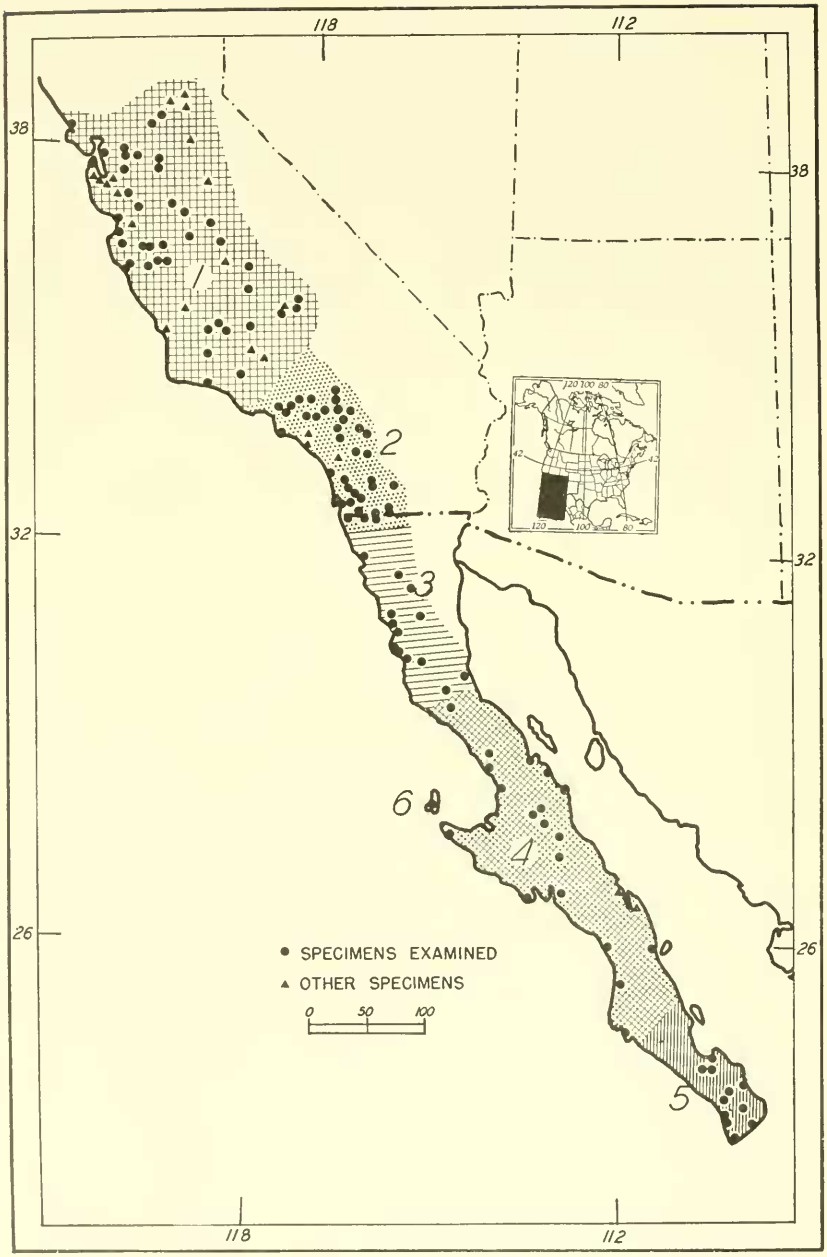


FIG. 5. Map showing the geographic distribution of the coronatum group.

1. *Phrynosoma c. frontale*
2. *Phrynosoma c. blainvillii*
3. *Phrynosoma c. schmidti*
4. *Phrynosoma c. jamesi*
5. *Phrynosoma c. coronatum*
6. *Phrynosoma cerroense*

2722-24); Loreto, Mission San Fernando, near Lat. 30°, 6 mi. E (LMK 40414); Punta Prieta, Lat. 28°58′ (SSNH 16705), 2 mi. NW (MVZ 37329), 10 mi. S (SSNH 18088), 18 mi. S (SSNH 18089); Punta San Jacinto, Lat. 30°52′, opposite (LMK 39656), base of (LMK 40024); Río San Rafael Valley, Lat. 31°50′ (LMK 40164); Rosario, 30°50′ 5 mi. E (MVZ 37326), 20 mi. E, 2 mi. S (MVZ 37327), 25 mi. E (LMK 38332), 30 mi. E (MVZ 37328), 36 mi. E (LMK 40409-10); San Antonio, Lat. 30°20′, 1 mi. N (SSNH 16707); San José, Lat. 31° (LMK 4576-89, 8822); San Quintin, Lat. 30°38′ (USNM 37585), (LMK 20160, 32618), (MVZ 37323), plains of (LMK 39364), 3 mi. E (SSNH 18080); 7 mi. NNW (MVZ 37321-22), 8 mi. SE (MVZ 37324); San Telmo (MVZ 9778); Santo Tomás Canyon, Lat. 31°34′ (LMK 39770), between Hamilton Ranch and (SSNH 16703-04); Socorro, Lat. 30°20′ (LMK 32129-30), 2 mi. SSE (MVZ 37325); Santa Domingo, Lat. 30°45′ (MVZ 37320), 18 mi. NW (MVZ 37319); Valle Trinidad (LMK 20038).

Cedros Island (AMNH 20583).

Phrynosoma cerroense Stejneger

Phrynosoma Belding, Proc. U. S. Nat. Mus., vol. 5, 1883, p. 530.

Phrynosoma hernandezi Yarrow, Bull. U. S. Nat. Mus., no. 24, 1883, p. 68 (*part.*); Belding, West Amer. Scientist, vol. 3, no. 24, 1887, p. 99.

Phrynosoma cerroense Stejneger, N. Amer. Fauna, no. 7, 1893, p. 187; Van Denburgh, Proc. California Acad. Sci., ser. 2, vol. 5, 1895, p. 199; Cope, Report U. S. Nat. Mus. for 1898 (1900), p. 428, fig. 75; Van Denburgh, Proc. California Acad. Sci., ser. 3, vol. 4, no. 1, 1905, pp. 3, 23; Ditmars, Reptiles of the World, 1910, p. 151; Ditmars, Reptile Book, 1907, p. 151; Van Denburgh & Slevin, Proc. California Acad. Sci., ser. 4, 1914, pp. 132, 144; Stejneger & Barbour, Check List of North American Amphibians and Reptiles, 1917, p. 58; Nelson, Mem. Nat. Acad. Sci., vol. 16, 1922, pp. 114, 130; Schmidt, Bull. Amer. Mus. Nat. Hist. vol. 16, 1922, pp. 607-707; Van Denburgh, Occas. Papers California Acad. Sci. 1922, pp. 401-403; Stejneger & Barbour, Check List North American Amphibians and Reptiles, 1923, pp. 60-61; Cuesta Terron, Inst. Biol. Univ. Nat. Mus., 1932, p. 109; Stejneger & Barbour, Check List of North American Amphibians and Reptiles, 3 ed., 1933, p. 66; Klauber, Copeia, no. 2, 1936, pp. 103-110; Stejneger & Barbour, Check List of North American Amphibians and Reptiles, 4 ed., 1939, p. 72; Bull. Mus. Comp. Zool. Harvard Coll., vol. 93, 1943, p. 92.

Phrynosoma coronatum cerroense Linsdale, Univ. California Publ. Zool. vol., 38, no. 6, 1932, p. 368.

Diagnosis: Three rows of enlarged gular scales on each side; frontal scales of medium size, rugose and colored dark brown or black; four temporal spines on each side, fourth from rear, missing in adults, much reduced in young; subrictal in line with chinshields, postrictal present; chinshields usually reduced to four on each side.

Description: Head slightly longer than wide; frontal area flat, covered with medium sized, rugose scales; rostrofrontal angle obtuse; nares small, separated by distance equal to one and one-half

times diameter of one naris, nares within the canthal lines; supralabials and infralabials inconspicuous; chinshields, reduced to four on each side, in contact with infralabials; subrictal in line with chinshields; postrictal of medium size, cone shaped; three rows enlarged gular scales on each side; two neck patches enlarged lateral scales, upper patch only slightly enlarged; tympanum exposed; occipital shelf bearing four tubercles; occipital spines of medium size, interoccipital space equal to basal diameter of single spine; interoccipital spine small; four enlarged temporal spines, increasing in size posteriorly; superciliary ridge terminating posteriorly in short, blunt, triangular spine; dorsal scales small, imbricate, smooth; eight longitudinal rows of enlarged keeled scales between neck and rump; four rows continuing on rump and base of tail, converging into two rows on tail; two rows of enlarged flexible spines in lateral abdominal fringe, lower row markedly reduced; ventral abdominal scales small, smooth; femoral pores 17-18, rows separated mesially by two preanal scales.

Dorsal ground color steel-gray; dark nuchal spots distinct dorsally, fading ventrolaterally into ground color; three pair of equally spaced, irregular, dark gray to black blotches on remainder of back; tail with five indistinct, dark transverse bars; head olive; frontal scales dark brown to black; spines medium brown; ventral scales cream with numerous black spots.

Variation: Of the four specimens of this species available in this study three were fully adult and one a juvenile. In the adults the temporal spine that would normally, in *frontale* and *blainvillii*, be considered the fourth, is in *cerroense* reduced to a small scale at the base of the third, leaving the impression that only four spines are present. In the juvenal specimen this fourth spine was present in its proper place but was much reduced.

The frontal scales are of equivalent size, and texture in all the specimens, however, the dark coloring was less intense on the juvenile. The ground color varies from the steel-gray of the adults to a light brown in the juvenile. The pattern is more clearly distinguishable in the young specimen.

Discussion: While at the United States National Museum, I had an opportunity to compare the type specimens of *cerroense* and *jamesi*. The two specimens are of nearly equivalent size and both are in very good condition. The comparison demonstrated a great similarity in the two; so much so that no more than subspecific status would be considered if both were mainland forms. Their measure-

ments and proportions coincide closely, the color and color patterns were generally the same, the general scalation was the same (including a second lateral abdominal row, supposedly absent in *cerroense*) and in general the two appear to differ but little. However, at least one character seemed to separate the two. The five chinshields and the subrictal form in *jamesi*, the enlarged row of serrate scales along the lower jaw. This same series in *cerroense* was composed only four chinshields, the subrictal with a larger gap between the last chinshield, and the subrictal, compensating for the missing scale. Additional material appears to validate this difference, although a total of five specimens of *cerroense* is all that was available for this study.

The complete isolation of *cerroense* rather than the minor anatomical variations has, I believe, led to its designation as a full species. This appears to be in keeping with the general trend of taxonomists in handling insular forms, and undoubtedly is the best procedure in this particular case. A second form (*schmidti*) has been described from the island, and from my observations of the paratype at the American Museum of Natural History, it appears to be distinctly different from *cerroense* and very close to, if not identical with, specimens from northern Baja California here referred to as *P. c. schmidti.* The occurence of the two forms on the same island would seem to indicate that they were either variants of the same subspecies, as some believe to be the case, or that they are species distinct one from the other. I incline to the view that *cerroense* has reached full specific status and that *schmidti* is a subspecific form identical with the mainland form heretofore considered as the southern population of *frontale.* Collecting of additional specimens and a careful ecological study of their relationships on the island are needed before the true status of the forms will be known.

General distribution: This species is confined to Cedros Island.

Locality records: Mexico. *Baja California:* Cedros Island. SW side (SSNH 17369), village, 3 mi. S (SSNH 17370), no specific locality (LMK 24357), (USNM 11977).

Phrynosoma asio Cope

Phrynosoma asio Cope, Proc. Acad. Nat. Sci. Philadelphia, vol. 16, 1864, pp. 178-179; Günther, Biologia Centrali-Americana, Reptilia and Batrachia, 1890, p. 79; Cope, Rept. U. S. Nat. Mus., 1898 (1900), pp. 407-408; Gadow, Proc. Zool. Soc. London, 1905, pp. 194, 213; Ditmars, Reptiles of the World, 1910, p. 151; Smith, Trans. Kansas Acad. Sci., vol. 37, 1934, pp. 287-288; Oliver, Occas. Papers Mus. Zool. Univ. Michigan, no. 360,

1937, p. 10; Hartweg & Oliver, Misc. Publ. Mus. Zool. Univ. Michigan, no. 47, 1940, p. 16; Smith, Ann. Carnegie Mus., vol. 30, 1944, p. 89; Smith & Laufe, Trans. Kansas Acad. Sci., vol. 48, 1945, p. 337; Schmidt & Shannon, Fieldiana Zool., vol. 31, 1947, p. 74; Smith & Taylor, Univ. Kansas Sci. Bull., vol. 3, pt. 2, 1950, p. 328; Smith & Taylor, Bull. U. S. Nat. Mus., no. 199, 1950, p. 102.

Phrynosoma spinimentum, Peters, Monatsb. Akad. Wiss. Berlin, 1873, pp. 742-743.

Batrachosoma asio Bocourt, Mission Scientifique au Mexique et dans l'Amérique Centrale, Études sur les Reptiles, livr. 4, 1874, pp. 241-242, pl. 17, figs. 9a-e.

Taxonomic history: Cope (1864:178) named this species from specimens in the United States National Museum collected by John Xantus in Colima, Mexico. Bocourt (1874) placed it in his subgenus *Batrachosoma.* Cope (1900) placed the species in the genus *Phrynosoma.*

Peters (1873:742-743) described *P. spinimentum* as a new species from a specimen taken in Tehuantepec, Mexico. This is undoubtedly a specimen of *P. asio.*

Diagnosis: Nostrils on canthal line; two peripheral rows of abdominal spines; three or four series of gular scales; ventral abdominal scales keeled throughout.

Description: Head equally as broad as long; nostrils on canthal line, separated by two small scales; superciliary ridges distinct, edged with four or five elongated scales, terminating posteriorly in large sharp spine; frontal scales subequal; occipital horns smaller than largest temporal, directed from skull at angle of approximately 90°; two diverging temporal spines; tympanum large and exposed; infralabials and chinshields separated by maximum of three small sublabials; gular scales irregular in size, with three or four enlarged rows on each side; gular fold bearing patch on each side containing four enlarged pyramidal scales; lower of two neck patches in line with chinshields, upper in line with lateral abdominal fringe; neck patches of single lone spines set in rosette of smaller scales. Back covered with small imbricate scales interspersed with varying sizes of enlarged keeled scales; eight distinct longitudinal rows of enlarged, keeled scales between neck and rump; above rows converging into four on rump and base of tail; two rows on tail; short medium nuchal row of spines present; two rows of enlarged soft spines in lateral abdominal fringe; femur and tibia with two rows of spines; arms bearing several rows of strongly-keeled scales; ventral scales keeled throughout, less definitely so posteriorly; about thirty-five scales across widest part of abdomen; femoral pores eight to nine on a side, with 18 to 20 preanal scales separating the two rows.

Dorsal ground color ashy gray with pair of distinct dark-brown

neck blotches extending posteriorly outside largest row of spines; color becoming fainter posteriorly; four incomplete transverse, light-bordered bands in front of rump; bands may appear as alternating spots; tail bearing variable number of transverse bands. Ventral scales cream, without dark spots.

Variation: The ground color varies from a medium brown to a light gray. The pattern may be somewhat obscured by fading of the colors, but is generally discernible. In the young the pattern may or may not be apparent; the ventral scales are generally more heavily keeled and may carry a considerable amount of dark pigment, which is generally in spots.

Discussion: Individuals of this species probably reach the largest size found in the genus. The largest specimen measured in this study was the type (USNM 32216) from Colima, Mexico, which has a snout-vent measurement of 115 mm. and a total length of 202 mm. (approx. 8 inches). Twelve of thirty one specimens exceeded 100 mm. in snout-vent measurement.

The occurrence of this species in Guatemala represents the most southern locality recorded for any member of the genus. The type locality has been restricted to Colima city, Colima, Mexico, by Smith & Taylor (1950a).

Locality records: Mexico. *Colima:* Colima (city) (USNM 32216, 217); Tecomán (Smith, 1944). *Michoacán:* Apatzingán (Schmidt & Shannon, 1947); Copradice (Smith & Taylor, 1950b); La Salada (USNM 47739); San Salvador (Smith & Taylor, 1950b). *Guerrero:* Mezcala (on Río Balsas). *Oaxaca:* Escurana (USNM 111358-63), (AMNH 66919); Ranchero Poso Río (Hartweg & Oliver, 1940); Salina Cruz (AMNH 18477-81, 18483, 62320); San Genoino (USNM 47056-57); San Pedro (Hartweg & Oliver, 1940); Tehuantepec (USNM 30476-79, 113275, 11357), (AMNH 18476, 58627-38, 58060-61, 65815-18, 66922-25); 1 mi. N (AMNH 62607). *Chiapas:* no specific locality (Smith & Taylor, 1950b).

Central America. *Guatemala:* Savana Grande (Günther, 1890).

Phrynosoma cornutum (Harlan)

Agama cornuta Harlan, Journ. Acad. Nat. Sci. Philadelphia, vol. 4, 1825, p. 299, pl. 20; Harlan, Medical and Physical Researches, 1835, p. 141.

Phrynosoma bufonium Wiegmann, Isis von Oken, vol. 21, 1828, p. 367; Gray, in Griffiths Cuvier's Animal Kingdom; Syn. Rept., 1831, p. 45.

Tapaya cornuta Cuvier, Règne Animal, vol. 2, 1829, p. 37.

Phrynosoma cornutum Gray, *in* Griffiths, Cuvier's Animal Kingdom; Syn. Rept., 1831, p. 45; Holbrook, North American Herpetology, 1 ed. vol. 3, 1838, p. 55, pl. 9, and *idem*, 2 ed. vol. 2, 1842, p. 87, pl. 11; Dekay, Zoology of New York, vol. 3, 1842, p. 31; Gray, Catalogue of the Lizards in the

British Museum of Natural History, 1845, p. 229; Girard, *in* Stansbury's Exploration of the Valley of the Great Salt Lake of Utah, 1852, p. 360, pl. 8, figs. 1-6; Hallowell, Sitgreaves' Expedition down the Zuni and Colorado Rivers, 1853, pp. 119, 145; Baird & Girard, Proc. Acad. Nat. Sci. Philadelphia, vol. 6, 1853, p. 301; Baird & Girard, *in* Marcy's Exploration of the Red Rivers, 1854, p. 204; Hallowell, Proc. Acad. Sci. Philadelphia, vol. 8, 1856, p. 239; Girard, Exploring and Expeditions of Years 1838, 1839, 1840, 1841, 1842, under the command of Charles Wilkes, USN, vol. 20, 1858, Herpetology, p. 403, pl. 21, figs. 6-9; Baird, United

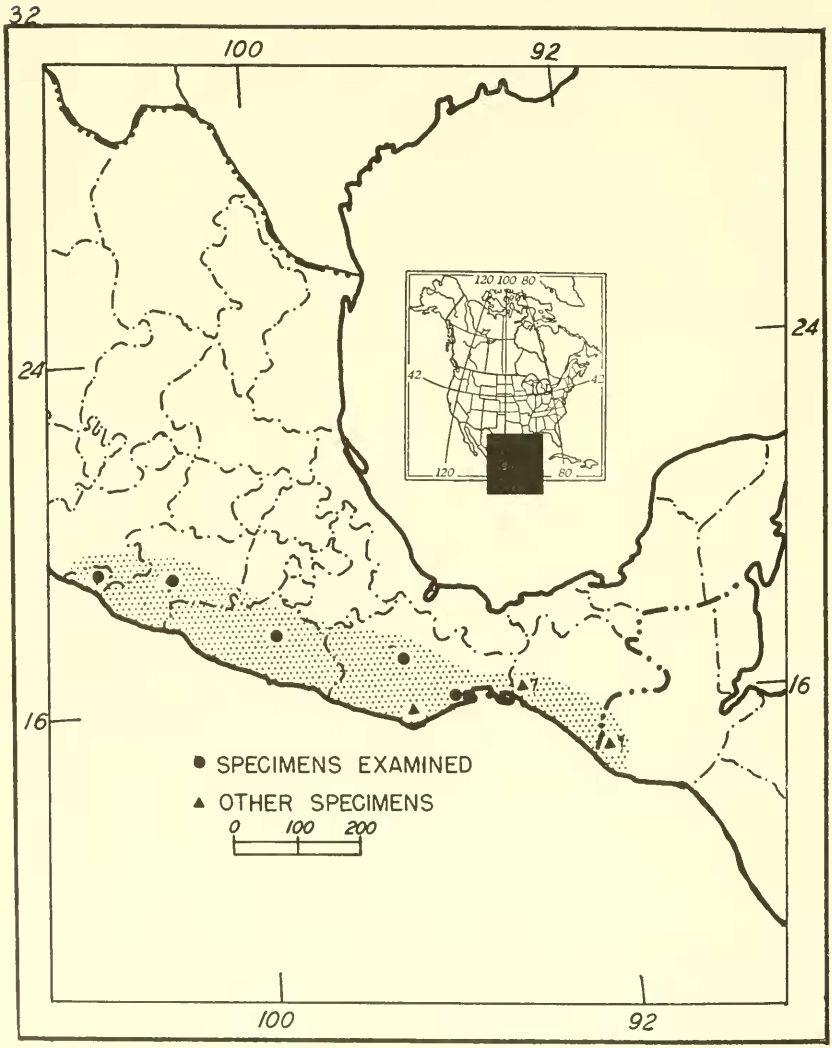


FIG. 6. Map showing the geographic distribution of the species *Phrynosoma asio*.

States Mexican Boundary Survey under the order of Lieut. Col. W. H. Emory, Reptiles of the Boundary, vol. 2, 1859, p. 9; Baird, Report of the Pacific Rail Road Survey, vol. 10, 1859, p. 37; Aug. Duméril & Bocourt, Mission Scientifique au Mexique et dans l'Amérique Centrale, Études sur les Reptiles, livr. 1, 1870, pl. 12, fig. 9; Bocourt, *idem*, livr. 4, 1874, pp. 236-238, pl. 12, figs. 9-9b; Cope, Proc. Amer. Philos, Soc., vol. 18, 1870, p. 261; Cope, Bull. U. S. Nat. Mus., no. 1, 1875, p. 49; Yarrow, Report of the Geography and Geology of the Survey West of the 100th Meridian, under Lt. Wheeler, vol. 5, 1875, p. 579 (*part.*); Yarrow & Henshaw, Report of the Chief of Engineers for Survey West of the 100th Meridian App. NN, 1878, p. 226 (*part.*); Müller, Verh. Nat. Gesell., Basel, 1878, p. 634; Cope, Proc. Amer. Philos. Soc., 1879, p. 261; Hoffman, Amer. Nat., vol. 13, 1879, pp. 326-327; Boettger, Zool. Garten, 1879, pp. 289-293; Cope, Bull. U. S. Nat. Mus., no. 17, 1880, pp. 17, 44, 46; Cragin, Trans. Kansas Acad. Sci., vol. 7, 1881, p. 114; Yarrow, Bull. U. S. Nat. Mus., no. 24, 1883, pp. 11, 66 (*part.*); Cope, Proc. Acad. Nat. Sci. Philadelphia, vol. 35, 1883, pp. 10, 12; Lockwood, Amer. Nat., vol. 17, 1883, pp. 682-683; Cragin, Bull. Washburn Lab. vol. 1, 1884, p. 7; Nehring, Zool. Garten, vol. 25, 1884, pp. 230-234, 259-262; Garman, Bull. Essex Inst. vol. 16, 1884, p. 19; Boulenger, Catalogue of the Lizards in the British Museum Natural History, vol. 2, 1885, pp. 245-246; Gentry, Proc. Acad. Nat. Sci. Philadelphia, vol. 22, 1885, p. 145; Schufeldt, Science, vol. 6, 1885, pp. 185-186; Cope, Proc. Amer. Philos, Soc. vol. 23, pt. 2, 1886, pp. 169, 282; Cope, Bull. U. S. Nat. Mus., no. 32, 1887, p. 398; Garman, Bull. Essex Inst., vol. 19, 1887, p. 13; Belding, West Amer. Sci., vol. 3, 1887, p. 98; Cope, Proc. U. S. Nat. Mus., vol. 11, 1888, p. 398; Günther, Biologia Centrali-Americana, Reptilia and Batrachia, 1890, p. 79; Cope, Proc. Acad. Nat. Sci. Philadelphia, vol. 29, 1892, p. 335; Van Denburgh, Proc. California Acad. Sci., ser. 2, vol. 6, 1896, p. 342; Edwards, Zool. Anz., vol. 19, 1896, p. 108; Edwards, Science, vol. 3, NS, pp. 763-765; Cockerell, Amer. Nat. vol. 30, 1896, p. 226; Herrick, Terry & Herrick, Bull. Sci. Labor. Denison Univ., vol. 11, 1899, pp. 135-136, pl. 19, fig. 16; Bull. Univ. New Mexico, vol. 1, 1899, p. 35; Cope, Rept. U. S. Nat. Mus. for 1898, (1900), p. 432, fig. 77 (*part.*); Gadow, Cambridge Natural History, vol. 8, 1901, pp. 533-534; Stejneger, Proc. U. S. Nat. Mus., vol. 25, 1903, p. 151; Edwards, Science, ser. 2, vol. 27, 1903, p. 826; Stone & Rehn, Proc. Acad. Nat. Sci. Philadelphia, vol. 55, 1903, p. 540; Brown, Proc. Acad. Nat. Sci. Philadelphia, vol. 55, 1903, pp. 552-546; Hurter, Trans. Acad. Sci. St. Louis, vol. 13, 1903, p. 82; Bailey, N. Amer. Fauna, no. 25, 1905, p. 43; Gadow, Proc. Zool. Soc. London, 1905, p. 213; Cragin, Trans. Kansas Acad. Sci., vol. 7, reprint, 1906, p. 114; Ruthven, Bull. Amer. Mus. Nat. Hist., vol. 8, 1907, p. 547, fig. 22; Ditmars, The Reptile Book 1907, p. 153, pl. 46, figs. 9, 13; Strecker, Proc. Biol. Soc. Washington, vol. 21, 1908, pp. 47-52, 72-73, 165-169; Strecker, Baylor Univ. Bull. vol. 12, 1909, pp. 1-9; Hunter & Strecker, Trans. Acad. Sci. St. Louis, vol. 28, 1909, p. 22; Strecker, Baylor Univ. Bull., vol. 13, 1910, p. 7; Gadow, Zool. Jahrb. vol. 29, 1910, p. 706; Ditmars, Reptiles of the World, 1910, p. 151; Stone, Proc. Acad. Nat. Sci. Philadelphia, 1911, p. 229; Lampe, Jahrb. Nassau. Ver. Naturk. vol. 64, 1911, p. 164; Hurter, Trans. Acad. Sci. St. Louis, vol. 20, 1911, pp. 133-135; Bryant, Univ. California Publ. Zool., vol. 9, 1911, p. 5; Ellis & Henderson, Univ. Colorado Studies, vol. 10, 1913, pp. 74-75, pl. 3, fig. 13, Van Denburgh & Slevin, Proc. California Acad. Sci., ser. 4, vol. 3, 1913, p. 392; Winton, Science, NS, vol. 40, 1914, pp. 311, 784; Strecker, Baylor Bull., vol. 28, 1915, p. 23; Winton, Copeia, no. 32, 1916, p. 81-84; Winton, Copeia, no. 39, 1917, pp. 7-8; Weese, Science, NS, vol. 46, 1917, pp. 517-518; Stejneger & Barbour, Check List of the North American Amphibians and Reptiles, 1917, p. 58; Redfield, Copeia, no. 53, 1918, pp. 13-14; Weese, Amer. Nat., vol. 53, 1919; pp. 33-54; Reese, Copeia, no. 103, 1922, pp. 15-16; Van Denburgh, Occas. Papers California Acad. Sci., no. 10, 1922, pp. 409, 420, pl. 35; Strecker, Sci. Soc. San Antonio, Bull. 4, 1922, p. 20; Stejneger & Barbour, Check List

of the North American Amphibians and Reptiles, 1923, 2 ed., p. 61; Engle, Copeia, no. 1, 1924, pp. 37-38; Van Denburgh, Proc. California Acad. Sci., ser. 4, vol. 13, 1924, pp. 191, 209-210; Ortenburger, Copeia, no. 155, 1926, p. 138, and Proc. Oklahoma Acad. Sci., vol. 6, 1926, p. 44; Cahn, Amer. Nat., vol. 60, 1926, pp. 547-551, figs. 1-2; Strecker, Contrib. Baylor Univ. Mus., no. 5, 1926, no pages; Burt, Occas. Paper Mus. Zool. Univ. Michigan, no. 189, 1927, p. 3; Frierson, Jr., Copeia, no. 165, 1927, p. 114; Ortenburger, Copeia, no. 163, 1927, p. 47; Strecker, Contrib. Baylor Univ. Mus., no. 12, 1927, p. 8; Burt, Trans. Acad. Sci. St. Louis, vol. 26, 1928, pp. 27-32, fig. 5; Strecker, Contrib. Baylor Univ. Mus., no. 16, 1928, p. 12; Burt, Journ. Kansas Ent. Soc., vol. 1, no. 3, 1928, pp. 56-58; Strecker & Williams, Contrib. Baylor Univ. Mus., no. 17, 1928, p. 14; Burt & Burt, Journ. Washington Acad. Sci., vol. 19, 1929, p. 454; Burt and Burt, Amer. Mus. Novitates, no. 381, p. 9; Ortenburger, Copeia, no. 170, 1929, p. 127; and no. 173, 1929, p. 94; Taylor, Univ. Kansas Sci. Bull., vol. 19, 1929, p. 64; Force, Copeia, no. 2, 1930, p. 28; Strecker, Contrib. Baylor Univ. Mus., no. 23, 1930, p. 4; Ortenburger, Publ. Univ. Oklahoma Biol. Surv., vol. 2, 1930, p. 227, fig. 30; Potter & Glass, Copeia, no. 3, 1931, p. 128; Burt, Proc. Biol. Soc. Washington, vol. 45, 1932, pp. 73-74; Gaige, Univ. Michigan Studies, Sci. Ser., vol. 12, 1932, p. 302; Cuesta Terron, Anal. Inst. Biol., vol. 3, 1932, pp. 113-115; fig. 16; Mosauer, Occas. Papers Mus. Zool. Univ. Michigan, no. 246, 1932, pp. 8-9; Burt, Trans. Kansas Acad. Sci., vol. 38, 1933, p. 190; Stejneger & Barbour, Check List of the North American Amphibians and Reptiles, 3 ed., 1933, p. 67; Smith & Leonard, Amer. Midl. Nat., vol. 15, 1934, p. 193; Smith, Trans. Kansas Acad. Sci., vol. 37, 1934, p. 289; Burt & Hoyle, Trans. Kansas Acad. Sci., vol. 37, 1934, p. 190; Burt, Amer. Midl. Nat., vol. 16, 1935, p. 324; Smith, Univ. Kansas Sci. Bull., vol. 22, 1935, p. 144; Strecker & Williams, Baylor Univ. Bull., vol. 38, 1935, pp. 21, 36; Rodeck, Copeia, no. 1, 1936, p. 70; Burt, Trans. Kansas Acad. Sci., vol. 38, 1936, pp. 260, 300, 305, fig. 13, 15; Breukelman & Downs, Trans. Kansas Acad. Sci., vol. 39, 1936, p. 267; Wood, Copeia, no. 1, 1936, pp. 69-70; Little and Keller, Copeia, no. 4, 1937, p. 219; Burt, Trans. Acad. Sci., vol. 40, 1937, p. 195; Gloyd, Bull. Chicago Acad. Sci., vol. 5, 1937, p. 113; Hewatt, Copeia, no. 4, 1937, 234; Milne, Copeia, no. 4, 1938, pp. 200-201; Dellinger and Black, Occas. Papers Univ. Arkansas Mus., no. 1, part 1, 1938, p. 1; Tihen, Trans Kansas Acad. Sci., vol. 40, 1938, p. 404; Brennan, Trans. Kansas Acad. Sci., vol. 40, 1938, pp. 343, 345-346; Schwardt, Bull. Univ. Arkansas Agr. Exp. Sta., no. 357, 1938, p. 36; Tihen & Sprague, Trans. Kansas Acad. Sci., vol. 42, 1939, p. 503; Klauber, Bull. Zool. Soc. San Diego, no. 14, 1939, p. 94; Stejneger and Barbour, Check List of the North American Amphibians and Reptiles, 3 ed., 1939, p. 73; Smith and Acker, Proc. Oklahoma Acad. Sci., vol. 20, 1940, p. 65; Moore and Rigney, Proc. Oklahoma Acad. Sci., vol. 22, 1942, p. 78; Driver, Name That Animal, 1942, p. 348; Kauffeld, Amer. Midl. Nat., vol. 29, 1943, p. 345; Stejneger and Barbour, Bull. Mus. Comp. Zool. Harvard Coll. vol. 93, 1943, p. 92; Marr, Amer. Midl. Nat., vol. 32, 1944, p. 482; Schmidt and Owens, Zool. Ser. Field Mus. Nat. Hist., vol. 29, 1944, p. 106; Schmidt and Smith, Zool. Ser. Field Mus. Nat. Hist., vol. 29, 1944, pp. 78, 84; Smith and Laufe, Trans. Kansas Acad. Sci., vol. 48, 1945, p. 338; Bogert & Oliver, Bull. Amer. Mus. Nat. Hist., vol. 83, 1945, pp. 315, 324, 334; Smith, Handbook of Lizards, 1946, pp. 290-293; Lowe, Herpetologia, vol. 4, 1947, p. 77; Maslin, Univ. Colorado Mus., Leaflet, no. 3, 1947, pp. 5, 111; Smith & Taylor Univ. Kansas Sci., Bull., vol. 33, pt. 2, 1950, p. 258; Bull. U. S. Nat. Mus., no. 199, 1950, p. 102.

Phrynosoma harlanii Wiegmann, Herpetologia Mexicana, 1834, p. 54; Duméril & Bibron, Érpetologie Générale, vol. 4, 1837, p. 314; Spring and Lacordaire, Bull. Acad. Roy. Brussels, pt. 2, 1842, p. 192, fig. 2; Duméril and Duméril, Catalogue Methodique de la Collection des Reptiles du Museum d'Histoire Naturelle de Paris, 1851, p. 28.

Phrynosoma orbiculare Holbrook, North American Herpetology, 1 ed. vol. 3, 1838, p. 61, pl. 10 and *idem*, 2 ed. vol. 2, 1842, p. 93, pl. 12.

Phrynosoma (*Tropidogaster*) *cornutum* Fitzinger, Systema Reptilium, 1843, p. 79.

Phrynosoma (*Tropidogaster*) *bufonium* Fitzinger, Systema Reptilium, 1843, p. 79.

Phrynosoma plainceps Hallowell, Proc. Acad. Nat. Sci. Philadelphia, 1852, p. 178; Hallowell, *in* Sitgreaves' Expedition down the Zuni and Colorado Rivers, 1853, p. 124, pl. 7; Duméril, Arch. Mus. Hist. Nat. Paris, vol. 8, 1855, p. 552; Aug. Duméril and Bocourt, Mission Scientifique au Mexique et dans l'Amerique Centrale, Études sur les Reptiles, livr. 1, 1870, pp. 236-238, pl. 12, figs. 9-9a-f; Bocourt, *idem*, livr. 4, 1874, p. 238; Cope, Bull. U. S. Nat. Mus., no. 1, 1875, p. 49; Yarrow, Report of the Geography and Geology of the Survey West 100th Meridian, under Lt. Wheeler, vol. 5, 1875, p. 579, pl. 24, figs. 1-1b; Coues, *idem*, vol. 5, 1875, p. 593, pl. 24, figs. 1-16; Dugès, La Naturaliza, ser. 2, no. 2, 1896, p. 479.

Phrynosoma cornutum planiceps G. A. Boulenger, Catalogue of the Lizards in the British Museum of Natural History, vol. 2, 1885, p. 246.

Phrynosoma brevicornis E. A. Boulenger, Proc. Zool. Soc. London, 1916, p. 537, pl. 1, fig. 3.

Phrynosoma m'callii Wood, (*nec.* Hallowell), Copeia, no. 1, 1936, pp. 64-70.

Taxonomic history: The species was first named by Harlan (1825) *Agama cornuta.* At least part of the specimens upon which he based his description were in the collection of the Philadelphia Museum of Natural History. Two specimens in particular were mentioned as having been prepared and deposited in the collection. He did not designate a type specimen and gave the distribution as "The Great Plains east of the Rocky Mountains."

When Wiegmann (1828) proposed the generic name *Phrynosoma* he described, along with others, the species *Phrynosoma bufonium* using specimens supposedly from Surinam (Dutch Guiana). Later (1834) he doubted the validity of this locality, especially so after comparing *P. bufonium* with *Agama cornuta* and finding them nearly identical. However, he retained them as separate species, substituting the name *P. harlanii* for *Agama cornuta,* and placing the latter in synonymy. Meanwhile Gray (1831) recognized both *bufonium* and *cornuta,* placing them under *Phrynosoma.*

Duméril and Bibron (1837) recognized that the species *P. bufonium* was identical with *Agama cornuta,* but in their work they followed Wiegmann (1834) and for both species used the name *P. harlanii.* Fitzinger (1843) again recognized two species: *P. cornutum* Gray, under which he placed in synonymy, *Agama cornuta* Harlan and *P. harlanii* Wiegmann; and the second, *P. bufonium* Wiegmann, under which he placed *P. harlanii* of Duméril and Bibron. Fitzinger further grouped the two species into the subgenus *Tropidogaster.* Girard (1852) disregarded Fitzinger's subgeneric division and recognized *P. cornutum* (Harlan) as valid but chose to "lay aside" *P. bufonium* in the absence of authentic locality data. However, he later (1858) placed *P. bufonium* under

P. cornutum, which in turn, he placed in the subgenus *Phrynosoma.* He commented that Fitzinger's *Tropidogaster* had been in use since 1837 for another form and therefore could not be used here. In this same work, Girard placed *P. planiceps* Hallowell under *P. cornutum.* Boulenger (1885) later re-established *planiceps* as a subspecies of *P. cornutum.* Cope (1900) recognized only *P. cornutum.*

Smith and Taylor (1950a) have restricted the type locality of *cornutum* to Fort Riley, Geary Co., Kansas.

Diagnosis: Nostrils within the canthal line; two lateral abdominal scale rows; keeled ventral scales; a single row of enlarged gular scales.

Description: Head as wide as long; snout blunt, forming an acute angle with the frontal area; nostrils large, well within the lines of the canthi, the distance separating them less than diameter of nostril; frontal scales irregular, some pointed and rugose; superciliary ridge terminating posteriorly in a small, erect, often triangular spine; two long occipital spines; a small interoccipital spine; occipital area immediately in front of horns supplied with varying number of small rugose tubercles; temporal areas moderately expanded, projecting posteriorly only as far as, or but slightly farther than, center of occipital area; three temporal spines, middle one usually longest; tympanum not scaled over, although sometimes hidden by fold of skin; three groups of enlarged scales, varying in number, on lateral surface of neck; chinshields eight on each side increasing in size posteriorly and separated from infralabials by one or two small sublabials; a single row of enlarged gular scales on each side; back covered with small imbricate scales, interspersed among varying sizes of enlarged keeled scales; largest scales forming center of dark spots; two rows of slightly enlarged, dark keeled scales paralleling single, medial row of light nonkeeled scales; latter lying exactly above vertebral column; two rows of enlarged pointed scales bordering lateral edge of abdomen; upper row considerably larger than lower; tail edged by single row of peripheral scales equivalent in size to those of abdomen; medium sized, imbricate, keeled scales on anterior and dorsal surfaces of front legs; hind legs bearing dorsally two indistinct rows of enlarged scales with few moderate, imbricate, keeled scales on front of femur; scales of tail much like those of body; ventral scales imbricate, keeled; femoral pores nine to 15 on each side, rows separated mesially by 15 to 20 preanal scales; ground color of head white or light gray, this color replaced on snout by medium brown;

two or three brown to black bands traverse frontal area, the most posterior one connecting superciliary spines; two similar bands on side of head, one extending from eye ventrally, second posterolaterally over temporal area; single pair of large dark brown neck blotches immediately behind head, separated mesially by expanse of light ground-color; three pairs of smaller less definite patches on back, last one being on rump, all more or less outlined by white or gray ground color; dorsal spots each including single large, keeled scale; second but smaller row of spots paralleling first; remainder of back light gray to light tan; tail with single pair of basal spots followed by several dark transverse bands; arms traversed by several dark bands; legs similarly marked; ventral color pinkish gray to white, with numerous dark brown spots over abdomen; tail and limbs uniform light gray.

Variation: The largest specimens are from Texas and Mexico, and are 20 millimeters longer than the largest specimen from Kansas. Specimens from intermediate areas are intermediate in size. Annual length of the feeding period seems to control the size.

The variation in the ground color is considerable, often varying with the substratum upon which the animal lives. The color pattern, however, is more constant, although often varying in distinctness.

Discussion: Of the several forms described that are here regarded as synonyms of this species, there seems to be at least one about which some doubt exists, this being *P. brevicornis* E. G. Boulenger. The description of *brevicornis* was made from a single specimen taken by Prof. J. S. Huxley in Texas and given to Dr. H. G. F. Spurrell for presentation to the Zoological Society of London. It was kept alive in the Societies Gardens where E. G. Boulenger (1916) curator at the Gardens made the description. Burt (1932) placed it in the synonymy of *P. cornutum* upon the evidence received in a letter from Mr. H. W. Parker of the British Museum. Mr. Parker in his letter (quoted by Burt) comments upon a number of abrasions found on the type specimen that were not mentioned by Boulenger. One abrasion he found covered the occipital area and accounted for the short occipital horns that were "worn down or broken off." Accompanying Boulenger's description are three excellent photographs obviously taken of the live animal. On none of these photographs is there any evidence of such an abrasion. Neither do the photographs show clearly the condition of the occipital horns. The photographs would further indicate

Boulenger's interest in the specimen before it died and, if we can believe the photographs, before the abrasions appeared. This is further supported by a note from Mr. Battersby of the British Museum in answer to several of my queries in which he states: "I am afraid I can say nothing definite on the state of the specimen when described by Boulenger. We received it in *July* 1916 [Italics mine] and the paper was received by the Zoological Society for publication on *May* (1916)." The description was in all probability made several weeks prior to its delivery to the "Society," which indicates a period of several months between the time the description was made and the delivery of the specimen to the Museum a period in which the abrasions could have occurred. This does not eliminate the possibility that the horns could have been broken off before the specimen reached the "Gardens." It is not unusual to find specimens in this condition.

Boulenger (*op. cit.*) records the specimen as coming from Texas but mentions no definite locality. Parker (in Burt *op. cit.*) mentions only Texas without further restriction. In reply to my inquiry Prof. Huxley, under date of November 7, 1949, replied as follows:

"I am sorry to say that I have, after nearly 30 years, no recollection of where the specimens you mention were collected. All I can say is that it must have been between Galveston, Austin and San Antonio, as this was the only region of Texas I visited."

Mr. Battersby stated that the locality record (as recorded in the British Museum) was Galveston, Texas.

A comparison of the description and photographs, of *brevicornis* with specimens of *cornutum* from Galveston and surrounding counties show that the two have a majority of their characters in common. The proportions of the head of the two appear to be different although this is not substantiated by actual measurement. The short horns of *brevicornis*, as shown in the photographs, and the failure of Boulenger to mention any abrasions upon the animal, presents a possibility that the specimen might be distinct. However, in view of the conflicting data regarding the type and my failure to locate any specimen that shows exactly the same combination of characters, I am prone to leave it in the synonymy of *cornutum*.

Distribution: The general distribution of this species is from northeastern Kansas and western Missouri, west through most of Kansas, southwest through Oklahoma, Texas, New Mexico to the southeastern part of Arizona, south through the northeastern part

of Sonora into Durango, and east to the Gulf of Mexico. It has been reported from Arkansas and Louisiana. In the latter region, part of the population is known to have been introduced.

Four jaw elements (presumably of this species although positive identification is impossible) are known (Gilmore 1928) from the Conard Fissure, 4 miles west of Willcockson, Newton Co., Arkansas. They are of late Pleistocene Age and are indistinguisable from the corresponding elements of the living animal.

Locality records: Louisiana. *St. Mary Parish:* Morgan City (USNM 25920); South Fork of Red River (Baird & Girard, 1853). *Caddo Parish:* Forbing (introduced) (Strecker & Frierson, 1926); Gayle, 1 mi. S (Frierson, 1927); Shreveport, Wall St. (Frierson, 1927).

Arkansas. *Sebastian Co.:* Fort Smith (Dellinger & Black, 1938).

Kansas. *Allen Co.:* Moran (KU 797-804). *Barber Co.:* Near Dances Cave (KU 19225); Sun City (KU 324-327), 7 mi. S (KU 17913-14). *Bourbon Co.:* (Burt, 1928). *Butler Co.:* Beaumont (KU 334-36). *Chase Co.:* no specific locality (KU 328, 359, 560), (USNM 53208). *Chautauqua Co.:* Cedarvale, 1½ mi. SW (KU 21069). *Clark Co.:* Ashland (AMNH 27238, 36917); Kingsdown, 6 mi. S (KU 22800); Stephenson's Ranch (KU 20229). *Comanche Co.:* Wilmore, 7 mi. NE (KU 20767-68). *Cowley Co.:* Arkansas City (USNM 90694), (KU 12009-018); no specific locality (AMNH 64554); Winfield (USNM 89954-55). *Crawford Co.:* No specific locality (Burt, 1928). *Dickinson Co.:* Carlton (KU 329-333); no specific locality (KU 505). *Elk Co.:* Paw Paw Creek (KU 352); no specific locality (KU 337). *Ellis Co.:* no specific locality (Burt, 1928), (Brennan, 1938). *Ellsworth Co.:* Horsethief Canyon (AMNH 36918). *Geary Co.:* Junction City (USNM 90696), (AMNH 37332); Fort Riley (USNM 6436, 104569-90), (KU 21246). *Greenwood Co.:* Eureka, 8 mi. S (KU 17101); Toronto, 3 mi. SW (KU 16826-29), 8 mi. SW (KU 17422, 16270); no specific locality (KU 356-58). *Harper Co.:* Anthony (KU 348-49); Harper, 5 mi. S (KU 17967-77). *Harvey Co.:* no specific locality (KU 350). *Kingman Co.:* Belmont (Burt, 1935); Zenda, 2 mi. S (KU 19334). *Kiowa Co.:* Rezeau Ranch (KU 21424). *Labette Co.:* Bartlett (KU 322-23); no specific locality (KU 353-54). *Lincoln Co.:* Eylvon Grove, 4 mi. SW (KU 17496); Lincoln (USNM 90695); no specific locality (AMNH 37327), (KU 16912). *Lyon Co.:* no specific locality (Breukelman & Downs, 1936). *McPherson Co.:* Marquette, 5 mi. S (KU 23962); no specific locality (AMNH 37068).

Meade Co.: Meade, 15 mi. SE (AMNH 62837-38); State Line, 1 mi. N (KU 20328); State Park (KU 17633-34). *Mitchell Co.:* Scottsville (AMNH 36916). *Montgomery Co.:* Independence (KU 14650); Wayside (KU 796); no specific locality (KU 339-42). *Morton Co.:* near Elkhart (KU 12023-31); no specific locality (KU 12063-82). *Neosho Co.:* no specific locality (Burt, 1928). *Ness Co.:* no specific locality (Burt, 1928). *Osborne Co.:* no specific locality (Burt, 1928). *Ottawa Co.:* Minneapolis, 3 mi. SW (Burt, 1937); no specific locality (Burt, 1928). *Pawnee Co.:* no specific locality (Burt, 1928). *Phillips Co.:* Glade, 4 mi. S (KU 18601-603). *Pratt Co.:* Cairo (USNM 44687). *Rawlins Co.:* no specific locality (Burt, 1928). *Riley Co.:* no specific locality (AMNH 37325-26). *Russell Co.:* O'Roke (KU 355). *Sedgwick Co.:* Clearwater (USNM 90697). *Seward Co.:* no specific locality (KU 22801). *Smith Co.:* no specific locality (KU 14649). *Sumner Co.:* no specific locality (Burt, 1928); Wellington (KU 323). *Wilson Co.:* Neodesha (AMNH 37331); no specific locality (KU 344-345), (USNM 53409).

OKLAHOMA. *Beckham Co.:* Sayre, 4 mi. S (USNM 92629). *Beaver Co.:* no specific locality (Marr, 1944). *Blaine Co.:* Canton, 5 mi. S (KU 18061-65), 5½ mi. S (KU 18531). *Caddo Co.:* Ft. Cobb (USNM 11831-32). *Carter Co.:* Ardmore (AMNH 7483-87). *Choctaw Co.:* Hugo (KU 16646). *Cimarron Co.:* Boise City (Ortenburger, 1927); Kenton, 3 mi. N (Ortenburger, 1927). *Cleveland Co.:* no specific locality (Ortenburger, 1926). *Comanche Co.:* Wichita Mts. (Ortenburger, 1926). *Cotton Co.:* Junction City 1 mi. SE (Burt, 1935). *Creek Co.:* Drumright (KU 16830-32). *Garfield Co.:* Bison, 1 mi. N (USNM 92623); Enid (USNM 92622). *Hughes Co.:* no specific locality (KU 16646). *Kay Co.:* Ponca City, 1 mi. S (Burt, 1935). *Lincoln Co.:* no specific locality (Ortenburger, 1926). *Logan Co.:* no specific locality (Smith & Acker, 1940). *Major Co.:* Togo, 8 mi. NW (USNM 99452). *Noble Co.:* Sumner, 2 mi. SE (Burt, 1935); near Perry (AMNH 36972-73); Three Sands, 2 mi. S (USNM 99369). *Okfuskee Co.:* Okemah, 3 mi. E (Burt, 1935). *Oklahoma Co.:* Crutcho (Burt, 1935). *Okmulgee Co.:* no specific locality (Ortenburger, 1926). *Pawnee Co.:* Pawnee (AMNH 37329). *Payne Co.:* Stillwater (USNM 53172). *Tulsa Co.:* Tulsa (USNM 89104-08, 125123-24). *Washita Co.:* no specific locality (Ortenburger, 1926). *Woods Co.:* Alva (KU 12056-59).

TEXAS. *Aransas Co.:* St. Josephs Island (USNM 120). *Archer Co.:* Dundee (AMNH 62896-99). *Atascosa Co.:* Benton (KU

12055, 12060-62). *Bastrop Co.:* Bastrop (Cragin, 1884). *Baylor Co.:* Lake Kemp (Strecker & Williams, 1935). *Bee Co.:* Beeville (USNM 44801-02). *Bell Co.:* Temple (Strecker & Williams, 1935); Troy (AMNH 36978). *Bexar Co.:* Near Helotes (KU 11277-78); San Antonio (USNM 10790), (AMNH 20378-81, 44399). *Bowie Co.:* no specific locality (Strecker, 1928 on word of R. C. Cowan). *Brewster Co.:* Alpine (USNM 33007, 33022, 44779-80, 92893); Altuda (USNM 33005); Chisos Mts. (USNM 103631). *Brown Co.:* Brownwood (AMNH 67223-24); Camp Bowie (AMNH 66079-81, 66113-114). *Burnet Co.:* Burnet (KU 267-274). *Castro Co.:* Dimmit (USNM 33012). *Callahan Co.:* Putnam (USNM 71749-50), (KU 12054). *Cameron Co.:* Brownsville (USNM 110, 25403, 52287), (KU 372-73, 11284-87); no specific locality (USNM 17081-82). *Cottle Co.:* Paducah (USNM 92696-703). *Clay Co.:* Henrietta (USNM 33018). *Comal Co.:* no specific locality (Strecker, 1927). *Concho Co.:* Eden, 8 mi. S (Burt & Burt, 1929). *Cooke Co.:* Gainesville (KU 12020-22); no specific locality (USNM 15538-40). *Coryell Co.:* near Cove (Burt & Burt, 1929). *Crosby Co.:* Silver Falls Lake (USNM 92760). *Dawson Co.:* Lamesa, 8 mi. N (KU 12084). *Denton Co.:* Denton (AMNH 36974). *Dimmit Co.:* Carrizo (USNM 33066). *Eastland Co.:* Cisco (KU 484, 394, 395, 398, 12083); no specific locality (Marr, 1944). *Ellis Co.:* Centerpoint (USNM 33013); Redoaks (KU 12085-89); Rockett, 3 mi. S (KU 11393); Waxahachie (USNM 38682). *El Paso Co.:* Ft. Bliss (USNM 4590, 4 spec., 83121-22), (AMNH 38656, 43285-86); El Paso (USNM 33031), (AMNH 15049). *Fisher Co.:* Grady (USNM 29650). *Frio Co.:* near Dilley (KU 11279), 22 mi. W (KU 13190). *Galveston Co.:* Virginia Point (USNM 33028-30); no specific locality (USNM 58562). *Dallas Co.:* Dallas (USNM 17395). *Grimes Co.:* Navasota (USNM 44600). *Hays Co.:* San Marcos (Strecker, 1927). *Hemphill Co.:* Miami, 9 mi. E (KU 16745-48). *Hidalgo Co.:* McAllen (USNM 82296-309), (AMNH 17405-06). *Hill Co.:* Hillsboro, 2 mi. N (AMNH 36977). *Howard Co.:* Big Springs, 9 mi. NW (USNM 92827); Knott, 1 mi. E (USNM 92813). *Houston Co.:* Antioch (USNM 33027). *Hudspeth Co.:* El Paso, 90 mi. below (USNM 143); Ft. Hancock (USNM 20658-61). *Jeff Davis Co.:* Davis Mts. (USNM 33023); Valentine (USNM 33014). *Jim Wells Co.:* Alice (USNM 45042-44). *Johnson Co.:* Grandview 3 mi. S (AMNH 36976). *Kendall Co.:* Waring (USNM 27057); Boerne, 7 mi. W (Strecker, 1926). *King Co.:* Guthrie (USNM 92719-23). *Kinney Co.:* Ft. Clark (USNM 20860-75). *Lipscomb Co.:* Gay-

lord, 5 mi. S (KU 23564-68). *Llano Co.:* Llano (USNM 33011). *McLennan Co.:* Waco (KU 11280-83, 12008); no specific locality (USNM 59029). *Martin Co.:* Stanton (USNM 92323-29). *Medina Co.:* Castorville (Strecker & Williams, 1935). *Menard Co.:* London, 4 mi. NE (USNM 83683). *Mitchell Co.:* Colorado (AMNH 6834-45). *Nueces Co.:* Corpus Christi (USNM 33019, 45304-56, 47702). *Oldham Co.:* Tascosa (USNM 33016). *Randall Co.:* near Umberger (KU 6542). *Reeves Co.:* Toyahvale (USNM 33004). *Refugio Co.:* no specific locality (Strecker, 1908). *Pecos Co.:* Ft. Stockton (USNM 5181, 33024, 92873). *Presidio Co.:* Marfa (USNM 47700). *Shackelford Co.:* no specific locality (USNM 12616). *Starr Co.:* Rio Grande City (USNM 33003), (KU 11276); Roma (USNM 33020). *Taylor Co.:* Abilene (AMNH 64786, 65470); Camp Barkley (BYU 6054-57). *Terrell Co.:* no specific locality (KU 13191). *Tom Green Co.:* San Angelo (AMNH 65305). *Travis Co.:* Austin (USNM 13465-69). *Val Verde Co.:* Comstock, 12 mi. E (AMNH 66056). *Victoria Co.:* Victoria (USNM 78549). *Webb Co.:* Laredo (KU 11273-75), (USNM 7123, 86901). *Wichita Co.:* Wichita Falls (USNM 45041), (AMNH 7498-7524); no specific locality (USNM 42303). *Williamson Co.:* no specific locality (Milne, 1938).

NEW MEXICO. *Chaves Co.:* Roswell (USNM 33009, 93006-07). *Dona Ana Co.:* Jornada Exp. Range (USNM 100885-86, 102234); La Cruces, 25 mi. N (KU 21410); Las Cruces (KU 17659); Organ Pass, E side (USNM 25430). *Eddy Co.:* Carlsbad (USNM 33008), (KU 12032-39). *Grant Co.:* Dog Springs (USNM 21011-13, 31015-17); Hachita (USNM 45099); Hurley (AMNH 28362). *Guadalupe Co.:* Santa Rosa (USNM 33010), (AMNH 44952). *Hidalgo Co.:* Animas Valley (USNM 45068, 45078); Lordsburg (USNM 92998-99). *Lea Co.:* Lovington (USNM 94357). *Luna Co.:* Deming (USNM 80073), (AMNH 66055), (KU 375); Silver City, 29 mi. SE (KU 6543). *Otero Co.:* Alamagordo (AMNH 539-46). *Quay Co.:* Tucumcari (KU 20530). *Rio Arriba Co.:* Abiquiu (Van Denburgh, 1924). *Socorro Co.:* Magdalina (KU 377); San Marcial (USNM 45070). *Union Co.:* Rabbit Ear Mts. (AMNH 62862); no specific locality (KU 12019). *Taos Co.:* Taos (Van Denburgh, 1924). *Mora Co.:* Ft. Union (Van Denburgh, 1924). *Santa Fe Co.:* Ildefonso (Van Denburgh, 1924); Santa Fe (Van Denburgh, 1924). *Sierra Co.:* Lake Valley (Van Denburgh, 1924).

ARIZONA. *Cochise Co.:* Benson, 9 mi. W (Klauber, 1939); 18 mi. NE (AMNH 68457-58); Bisbee (AMNH 1281); Bowie (USNM 8438); Douglas (KU 6963, 376), 22 mi. S (AMNH 63494), 27 mi. N (AMNH 66053-56); Ft. Huachuca (USNM 21001); San Pedro River (USNM 20564, 21019-20); Wilcox (USNM 22235), 12 mi.

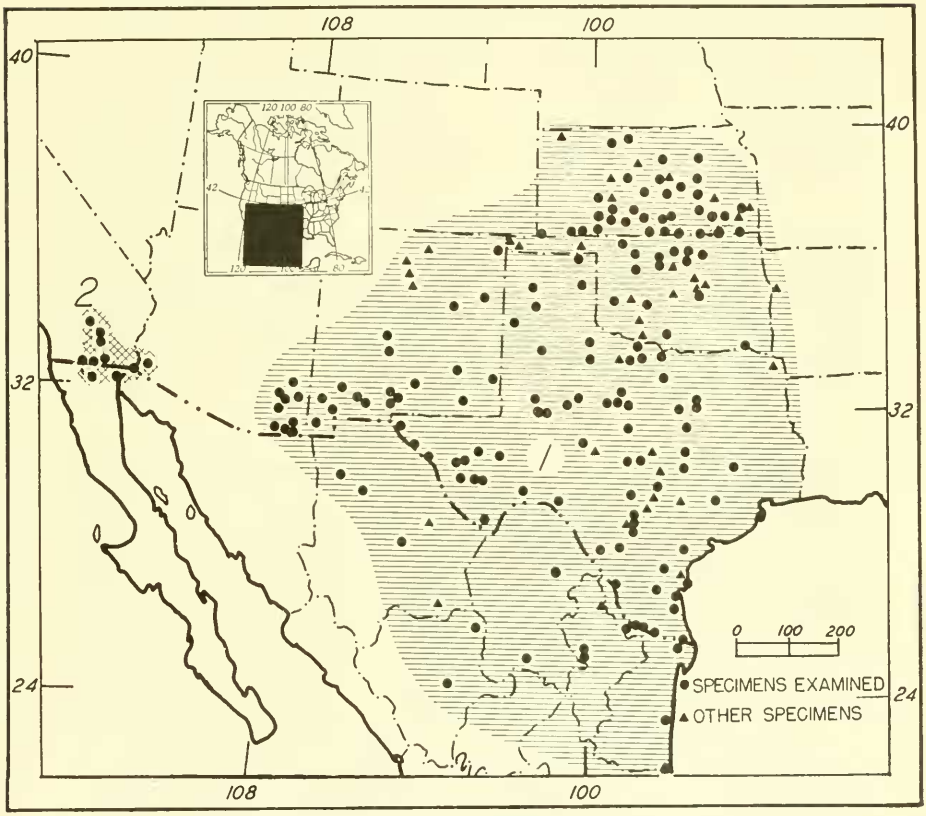


FIG. 7. Map showing the geographic distribution of the species: 1. *Phrynosoma cornutum*, and 2. *Phrynosoma m'callii.*

NW (USNM 44565). *Graham Co.:* SE Ariz. (USNM 8576); no specific locality (KU 21935).

MEXICO. *Chihuahua:* Allende (Schmidt & Owen, 1944); Ascensión, 27 mi. N (USNM 104692); Casas Grandes, (USNM 47475-77), 10 mi. EE. (USNM 104693-704), 14 mi. E. (USNM 104705); Chihuahua (city?) (USNM 14290, 14300, 64433-4); Hacienda La Babia (Sierra del Carmen), (Schmidt & Owen, 1944); Hacienda La Mariposa (Schmidt & Owen, 1944); Hacienda El Zacate

(Schmidt & Owen, 1944); Moctezuma (USNM 65831); 30 mi. N (KU 20528); Muzquiz (Schmidt & Owen, 1944); Rio Santa María near Progreso (USNM 104706-712); San Buenaventura, 12 mi. E (USNM 105310-11); San Juan (Schmidt & Owen, 1944); Santa Marcia (USNM 47173-79); Santa Rosa (USNM 47356-59); Villa Acuña (Schmidt & Owen, 1944); White Water Monument (USNM 21007-10). *Durango:* Bermejillo, 25 mi. N (KU 19255); San Juan del Río (AMNH 68341); La Loma, 7 mi. S (Smith, 1934); Lerdo, 15 mi. SW (AMNH 67450); Between Torreon & Bermejillo (KU 20529, 19254). *Sonora:* Sonora Mex. (USNM 92579). *Coahuila:* Álamos de Parras (USNM 114); Castañuelas (USNM 113); Las Delicias, 10 mi. E (AMNH 67382), 17 mi. S (AMNH 67381); Patos (USNM 112); Sabinas (USNM 47836). *Nuevo León:* Monterey (USNM 117), 20 km. N (USNM 111364); Nuevo Laredo, 25 mi. S (Smith, 1934); Santa Catarina (USNM 47835). *Tamaulipas:* Marmolejo (Gaige, 1932); Matamoros (USNM 107); Mier (USNM 47165-67); Soto la Marina (USNM 47834); Tampico (Günther, 1885).

Phrynosoma solare Gray

Phrynosoma solaris Gray, Catalogue of the Specimens of Lizards in the Collection of the British Museum of Natural History, 1845, p. 229; Van Denburgh, Proc. California Acad. Sci., ser. 2, vol. 4, 1894, p. 456.

Phrynosoma regale Girard, Report of the United States Exploring Expeditions during the years 1838, 1839, 1840, 1841, 1842, under the command of Charles Wilkes USN, vol. 20, 1858, Herpetology, p. 406; Baird, United States Mexican Boundary Survey under the order of Lieut. Col. W. H. Emory, Reptiles of the Boundary, vol. 2, 1859, p. 9, pl. 28, figs. 1-3; Cope, Proc. Acad. Nat. Sci. Philadelphia, 1866, pp. 202-203; Aug. Duméril and Bocourt, Mission Scientifique au Mexique et dans l'Amérique Centrale, Études sur les Reptiles, livr. 1, 1870, pl. 12, figs. 12a-f, and Bocourt *idem*, livr. 4, 1874, pp. 235-236, pl. 12, figs. 12a-b; Cooper, Proc. California Acad. Sci., vol. 4, 1870, p. 67; Cope, Bull. U. S. Nat. Mus., no. 1, 1875 p. 49; Yarrow, Report of the Geography and Geology of the Surveys West of the 100th Meridian, under Lt. Wheeler, vol. 5, 1875, Zoology, p. 578; Coues, *idem*, 1875, p. 593; Müller, Verh. Naturf. Gesell. Basel, 1878, p. 634; Lockington, Amer. Nat. vol. 14, 1880, p. 295; Yarrow, Bull. U. S. Nat. Mus., no. 24, 1883, pp. 11, 66; Boulenger, Catalogue of the Lizards in the British Museum of Natural History, vol. 3, 1885, p. 245; Gentry, Proc. Acad. Nat. Sci., Philadelphia, 1885, p. 146; Ditmars, The Reptile Book, 1907, p. 150, pls. 46, figs. 11, 15, and 49, fig. 1; Ditmars, Reptiles of the World, 1910, pp. 151-152; Stone, Proc. Acad. Nat. Sci. Philadelphia, 1911, p. 229.

Phrynosoma solare Van Denburgh, Proc. California, Acad. Sci., ser. 2, vol. 5, 1895, p. 115; Van Denburgh, *idem*, vol. 6, 1896, p. 342; Cope, Report U. S. Nat. Mus. for 1898 (1900), p. 420, fig. 73; Ruthven, Bull. Amer. Mus. Nat. Hist., vol. 23, 1907, pp. 544-546, fig. 21; Bryant, Univ. California Publ. Zool., vol. 9, 1911, p. 5; Van Denburgh & Slevin, Proc. California Acad. Sci., ser. 4, vol. 3, 1913, pp. 392, 406; Stejneger and Barbour, Check List of North American Amphibians and Reptiles, 1917, p. 60; Van Denburgh & Slevin, Proc. California Acad. Sci., ser. 4, vol. 11, 1921, p. 51; Van Denburgh, Occas. Papers California Acad. Sci., no. 10, vol. 1, 1922, pp. 406-409; pl. 34, figs. 1-2; Nelson, Mem. Nat. Acad. Sci., vol. 16, 1922, p. 114;

Stejneger & Barbour, Check List of North American Amphibians and Reptiles, 2 ed., 1923, p. 63; Ortenburger, Proc. Oklahoma Acad. Sci., vol. 6, 1926, p. 108; Burt & Burt, Journ. Washington Acad. Sci., vol. 19, no. 20, 1929, pp. 454-455; King, Copeia, no. 4, 1932, p. 177; Stejneger & Barbour, Check List of North American Amphibians and Reptiles, 3 ed., 1933, p. 69; Allen, Occas, Papers Mus. Zool. Univ. Michigan, no. 259, 1933, p. 10; Burt, Amer. Midl. Nat., vol. 14, 1933, p. 245; Taylor, Univ. Kansas Sci. Bull., vol. 24, 1936, p. 484; Gloyd, Bull. Chicago Acad. Sci., vol. 5, 1937, p. 113; Stejneger & Barbour, Check List of North American Amphibians and Reptiles, 4 ed., 1939, p. 75; Little, Copeia, no. 4, 1940, p. 263; Driver, Name That Animal, 1942, p. 348; Stejneger & Barbour, Bull. Mus. Comp. Zool. Harvard Coll., vol. 93, 1943, p. 95; Kauffeld, Amer. Midl. Nat., vol. 29, 1943, p. 345; Schonberger, Copeia, no. 1, 1945, pp. 53-54; Bogert & Oliver, Bull. Amer. Mus. Nat. Hist., vol. 83, 1945, pp. 303-420; Smith & Laufe, Trans. Kansas Acad. Sci., vol. 48, 1945, p. 337; Vorhies, Copeia, no. 4, 1948, p. 303; Edgren, Copeia, no. 2, 1948, p. 129; Smith and Taylor, Univ. Kansas Sci. Bull., vol. 33, pt. 2, 1950, p. 355; Bull. U. S. Nat. Mus., no. 199, 1950, p. 104.

Taxonomic history: Gray (1845) in his Catalogue of Lizards of the British Museum named *Phrynosoma solaris* from a specimen in the British Museum of Natural History from "California." His description, a single line, appearing under his discussion of *P. coronatum*, was sufficient to characterize the species. Girard (1852) does not mention this species or Gray's work. Later (1858) however, he placed *P. solaris* Gray in the synonymy of his *Batrachosoma coronatum* and described as new a species *P. regale*. Bocourt (1874) does not mention *P. solaris Gray*, but does list *P. regale* Girard as valid. Van Denburgh (1894) was the first to point out the validity of Gray's description and thus placed *P. regale* in synonymy. Cope (1900) after examining the type specimen reluctantly accepted Gray's one-sentence description and synonymized *P. regale*.

Diagnosis: One of the largest species in the genus, *P. solare* can be identified by the following characteristics: two pairs of occipital spines, which with the large temporal spines form a continuous series on posterior limits of head; nostrils within canthal line; two scale rows in lateral abdominal fringe; ventral scales keeled.

Description: Head slightly longer than wide, bearing posteriorly two pairs of occipital and four pairs of temporal spines, arranged in a continuous series; nostrils within the canthal lines; rostrum blunt; rostrofrontal angle abrupt; superciliary ridges prominent, ending posteriorly in a broad, pyramidlike scale; chinshields approximately eight on each side, increasing in size posteriorly; one incomplete row of sublabials between infralabials and chinshields; gular scales small; one row of enlarged scales extending from level

of fourth chinshield to gular fold; two distinct groups of enlarged scales on side of neck; tympanum exposed; dorsal scales generally small; eight dorsal longitudinal rows of enlarged scales on back, four extending onto the tail; one scale row in abdominal fringe; abdominal scales proportionately small and keeled; femoral pores 17 to 19 on each side.

Dorsal ground color grayish tan to reddish; neck blotches dark brown to black, often extending posteriorly along lateral portion of back; paravertebral spots irregular, often appearing as undulating broken bands, usual light borders often missing; tail traversed by narrow dark bands; head yellowish tan with points of larger scales often dark; ventral area with scattered dark spots.

Variation: The large head spines vary in length and in the angle at which they diverge from each other; however, two occipitals and four temporals are always present on each side. The fourth temporal may be reduced in size and appear as an enlarged scale at the base of the third. The keeling may be distinct upon all the ventral scales or it may be absent on all but a few scales in the area between the front legs. Size and age seem to have no effect upon the presence or absence of the keeling. The femoral pores vary from 15 to 23 on each side and from one to six preanal scales separate the femoral pore-rows mesially.

The ground color varies with the substratum but the dorsal pattern is usually clearly discernible. It is faint in some specimens.

Remarks: This species is one of the largest found in the genus. Three specimens (KU ♀ 22798, ♀ 22787, ♀ 396) have snout-vent measurements of 117, 115, and 114 mm. respectively; the total length of the largest (KU 22798) being 163 mm. (approx. 6½ inches). Ortenburger (1926) and Smith (1946) have suggested that the species might be divisible into several subspecies. Analysis of the material available for this study fails to give basis for such a division.

Distribution: The general distribution of this species is through the central part of Arizona, southwestward to the Colorado River, south into Sonora, following the Gulf of Mexico into Northern Sinaloa and north to the southeast corner of Arizona. Smith and Taylor (1950a) have restricted the type locality to Yuma, Yuma Co., Arizona.

Locality records: ARIZONA. *Cochise Co.:* Huachuca Mts., Romero Canyon (KU 6968). *Graham Co.:* Whitlock Mts. near Natural Gate (MVZ 23989). *Gila Co.:* Globe (MVZ 6308); Payson,

20 mi. S (MVZ 2243); no specific locality (MVZ 21932). *Maricopa Co.:* Higley (USNM 63047); Phoenix (KU 11319-21, 22786-87), (USNM 37962, 46223, 71523); Wickenburg (USNM 89954); no specific locality (KU 21933). *Pima Co.:* Benson, 12 mi. W (MVZ 8185); Nogales, 30 mi. N (MVZ 10169); Santa Catalina Mts., Sabino Canyon (KU 11317-18); Tucson (USNM 17170, 118588-89, 84257, 85966), (BYU 8047), 30 mi. S (EHT-HMS 10436); no specific

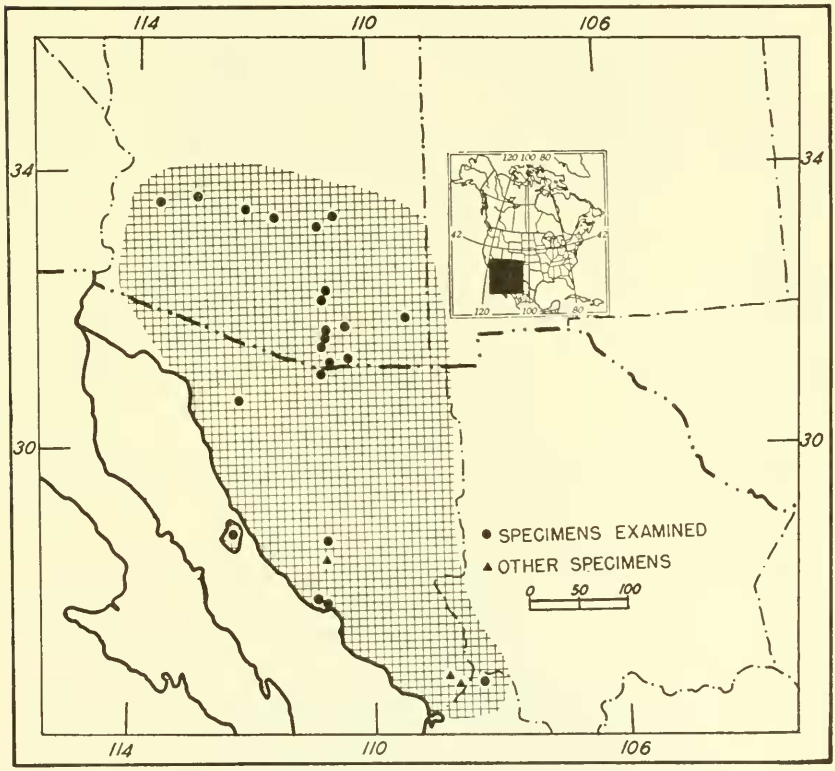


FIG. 8. Map showing the geographic distribution of the species *Phrynosoma solare.*

locality (USNM 61380, 2 spec.). *Pinal Co.:* Superior (EHT-HMS 10435). *Santa Cruz Co.:* Nogales (MVZ 62059); Tubac (MVZ 20541). *Yuma Co.:* Harquahala Mts. (USNM 60175-76).

MEXICO. *Sonora:* Álamo Muerto, 30 mi. NW Cabonea (MVZ 10167-68); Álamos (Bogert and Oliver, 1945); Empalme (EHT-HMS 10439); Guaymas (EHT-HMS 10440); Guirocoba (Bogert and Oliver, 1945); Hermosillo, 8 mi. S (EHT-HMS 10437), 15-20 mi. S (Allen, 1933); La Posa, 1 mi. W (EHT-HMS 10438); Nogales

(USNM 62075, 62256); Sierra de la Nariz, near Zuñi (USNM 161); Santa Ana (EHT-HMS 10441); Tiburón Islands, no specific locality (USNM 48148). *Sinaloa:* Sierra de Choix (USNM 47541). *Baja California:* Las Ánimas Bay (Lockington, 1880*).

Phrynosoma taurus Dugès

Phrynosoma taurus, Dugès, Desc. Manuscript (*fide* Duméril and Bocourt *loc. cit.*, p. 234), 1869; and La Naturaleza, 1869, p. 143 (*nomen nudum*); Aug. Duméril and Bocourt, Mission Scientifique au Mexique et dans l'Amérique Centrale, Études sur les Reptiles livr. 1, 1870, pl. 12, figs. 8, 8a-g; Bocourt, *idem*, livr. 4, 1874, pp. 234-235, pls. 1, 2, figs. 8a-g; Dugès, La Naturaleza, 1873, pp. 302-305, figs. 1-4; Boulenger, Catalogue of Lizards in the British Museum of Natural History, vol. 2, 1885, p. 249; Ditmars, Reptiles of the World, 1910, p. 151; Ruthling, Copeia, no. 72, 1919, pp. 67-68; Smith & Necker, Anales de la Escuela Nacional de Ciéncias Biologica, vol. 3, nos. 1-2, 1943, pp. 208- 210, figs. 1-2; Smith & Laufe, Trans. Kansas Acad. Sci., vol. 48, 1945, p. 337; Smith & Taylor, Univ. Kansas Sci. Bull., vol. 33, pt. 2, 1950, p. 341; Bull. U. S. Nat. Mus., no. 199, 1950, p. 104.

Taxonomic history: Dugès (1869) described this species from specimens in Mexico, and sent the manuscript to Aug. Duméril in Paris. In Paris a figure was made from one of nine specimens housed there and the figures were published under the name *Phrynosoma taurus* Dugès. The species has never been placed in any other genus.

Diagnosis: Nostrils within the canthal lines; one row of lateral abdominal spines; ventral scales keeled throughout; temporal shelf greatly extended posterolaterally terminating in a heavy, moderately long temporal spines.

Description: Head slightly broader than long; frontal areas inclined sharply forward and bordered by prominent superciliary ridges terminating posteriorly in an enlarged superciliary spine; nostrils located within canthal lines, of moderate size, separated from each other by a distance equal to one or one and one-half times diameter of nasal openings; occipital spines small; temporal area much enlarged posterolaterally, terminating in two, moderately long spines; outer larger and longer than inner; temporal spine far exceeding occipital in backward projection; scales of temporal area increase in size toward temporal spines; tympanum exposed; supralabials and infralabials small, latter separated from chinshields by one or two small sublabials; chinshields keeled, moderately pointed, increasing in size posteriorly; one slightly en-

* There have been no additional specimens taken in Baja California, the nearest being those collected in Yuma Co., Arizona, and Sonora, Mexico. The occurrence of this species in Baja California is gravely doubted.

larged row of scales on either side of gular area; gular fold covered posteriorly by minute scales; neck fold expanded and bearing series of enlarged scales; second smaller fold joining first posteriorly; numerous enlarged, keeled scales scattered over back; single lateral abdominal row borne anteriorly on fold of skin originating

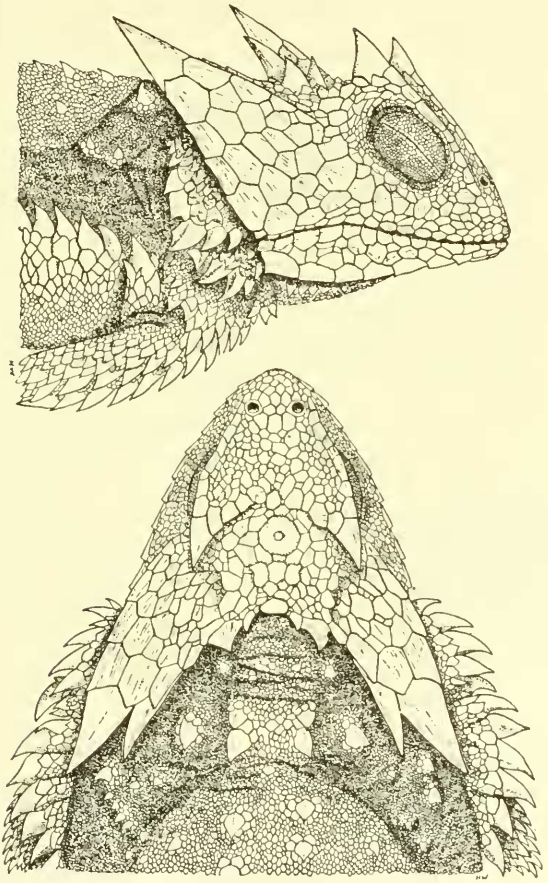


PLATE XC. *Phrynosoma taurus* Dugès. EHT-HMS No. 23987, 5 mi. N Chilpancingo, Guerrero, Mexico.

on shoulder above arm; fold diminishing posteriorly and disappearing at about one half to two thirds body length; tail short, approximately equal to, or less than, length of head; ventral scales keeled throughout; femoral pores numbering from ten to twelve on each side; rows separated mesially by approximately 20-23 preanal scales. Head olive, body slightly darker gray; neck

blotches dark gray with three pairs of faint blotches on body posterior to them; single faint band traversing tail; faint dark spots scattered over ventral area.

Discussion: This species is one of the most distinctive of the genus. The prolongation of the supratemporal areas is distinctly

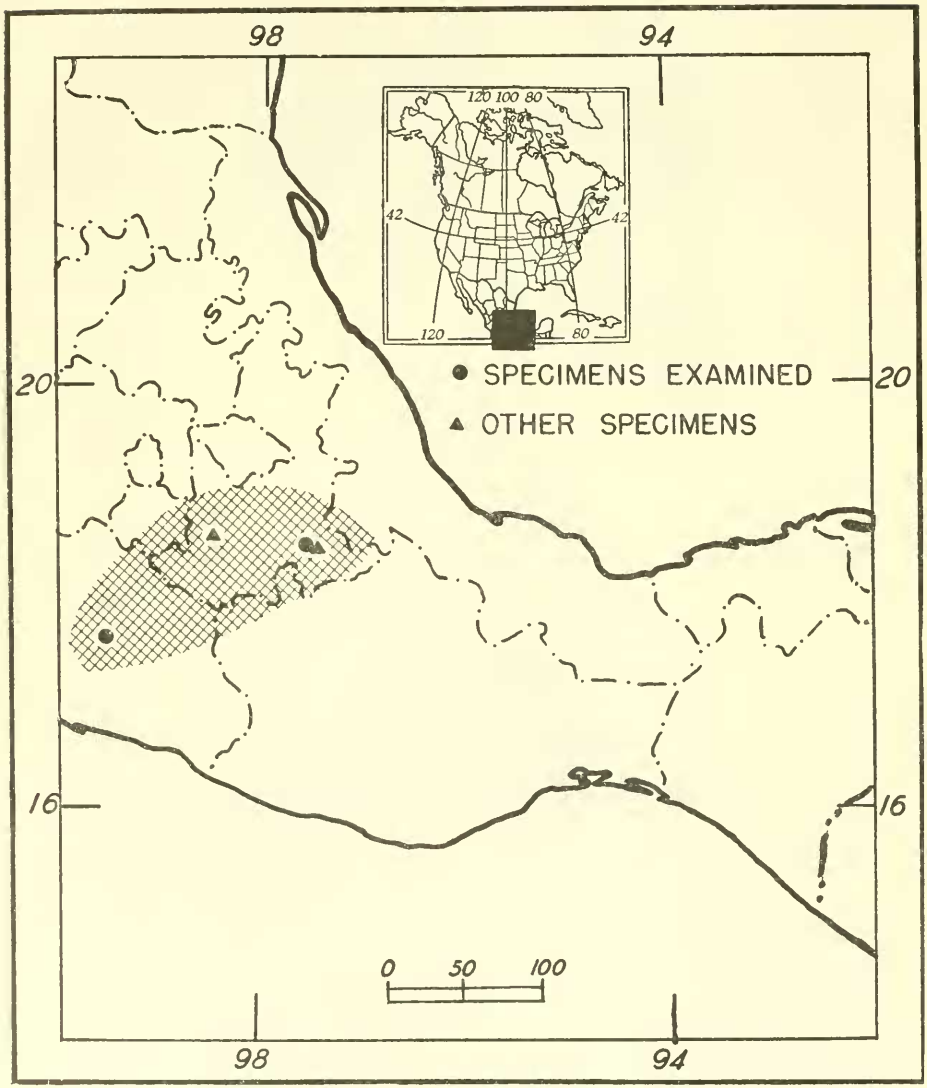


FIG. 9. Map showing the geographic distribution of the species *Phrynosoma taurus*.

greater than in any other form. Its affinities seem to be remotely with *douglassii.*

Locality records: Mexico. *Puebla:* Cacoloápam (EHT-HMS 22246); Cozcatlan, near Tehuacán (Anales de la Escuela Nacional de Ciéncias Biologia); Izúcar de Matamoros (9 spec. Mus. d'Hist. Nat. Paris); San Diego (USNM 11368). *Guerrero:* Chilpancingo, 5 mi. N (EHT-HMS 23987).

Phrynosoma douglassii brevirostre Girard

Tapaya° *brevirostris* Girard, *in* Report of the Exploring Expeditions during the years 1838, 1839, 1840, 1841, 1842 under the command of Charles Wilkes, USN, vol. 20, Herpetology, 1858, p. 397; Bocourt, Mission Scientifique au Mexique et dans l'Amérique Centrale, Études sur les Reptiles, livr. 4, 1874, pp. 285-289.

Phrynosoma brevirostre Cope, Proc. Acad. Nat. Sci. Philadelphia, 1866, p. 302; Stejneger & Barbour, Check List of North American Amphibians and Reptiles, 1917, p. 58; Stejneger & Barbour, *idem,* 2 ed., 1923, p. 60; Burt, Copeia, 1927, pp. 53-54; Burt, Trans. Acad. Sci. St. Louis, vol. 27, 1928, p. 32; Stejneger & Barbour, Check List of North American Amphibians and Reptiles, 3 ed., 1933, p. 66; Stejneger & Barbour, *idem,* 4 ed., 1939, p. 72; Hudson, Nebraska Conservation Bull. no. 24, 1942, pp. 36-38; Stejneger & Barbour, Bull. Mus. Comp. Zool. Harvard Coll., vol. 93, 1943, pp. 91-92; Wheeler, Amer. Midl. Nat., vol. 38, 1947, p. 181.

Phrynosoma douglassii douglassii Cones & Yarrow, Bull. U. S. Geology and Geography Surveys west of the 100th Meridian under Lieut. Wheeler, vol. 5, Zoology, 1878, pp. 285-287.

Phrynosoma hernandesi Stone, Proc. Acad. Nat. Sci. Philadelphia, 1911, p. 229.

Phrynosoma douglassii hernandesi Cope, Rept. U. S. Nat. Mus. for 1898 (1900), pp. 413-415 (*part.*); Over, South Dakota Geol. and Nat. Hist. Surv. Bull., vol. 12, 1923, p. 19; Brennan, Trans. Kansas Acad. Sci., vol. 37, 1934, p. 190; Burt & Hoyle, Trans. Kansas Acad. Sci., vol. 37, 1934, p. 201.

Phrynosoma douglassii ornatissimum Burt, Trans. Acad. Sci. St. Louis, vol. 26, 1928, pp. 32-36, fig. 6.

Phrynosoma orbiculare brevirostre Klauber, Bull. Zool. Soc. San Diego, no. 14, 1939, p. 93.

Phrynosoma douglassii brevirostre Smith, Handbook of Lizards, 1946, pp. 302-304, pl. 79; Maslin, Univ. Colorado Mus. Leaflet, no. 3, 1947, pp. 5, 11.

Taxonomic history: This subspecies was first named by Girard (1858) from specimens in the United States National Museum. He placed it in the subgenus *Tapaya.* The distributional data accompanying the description was merely the "plains of Kansas and Nebraska." To my knowledge a type specimen has never been designated, although number 208 of the United States National Museum collected by S. W. Wood at Pole Creek, Nebraska, is recorded as the type in the cards at that Museum. In view of the above, I here designate USNM 208 as the type of *Tapaya brevirostris* Girard, and restrict the type locality to Pole Creek (now Lodge Pole Creek) near Dix, Kimball Co., Nebraska. Smith (1946) made *brevirostre* a subspecies of *douglassii.*

° Actually considered as a subgenus, hence Girard has no parentheses.

Diagnosis: Temporal spines shorter than their basal diameter; head width at angle of jaw exceeding that of temporal area; dorsal spots indistinctly bordered or bordered only on posterior edges by lighter color.

Description: Size small; head wider than long, frontal area slightly convex, covered with small, irregular, rugose scales; superciliary ridges prominent, terminating in short, blunt, triangular spines; nostrils on canthal line, of medium size, separated by a distance equal to four or four and one-half times diameter of one nostril; temporal shelf expanded, convex; temporal spines small, shorter than their basal diameters, projecting vertically; interoccipital spine absent; occipital shelf bearing several small tubercles; supralabials small, inconspicuous; three posterior infralabials slightly enlarged, continuous with the three enlarged postlabials; chinshields small, separated from infralabials by two small sublabials; gular scales small, equal; two lateral neck patches of enlarged soft spines, lower patch smaller; tympanum exposed dorsal scales minute, smooth, imbricate; six to eight indistinct longitudinal rows of enlarged keeled scales; one row of slightly enlarged, soft scales forming lateral abdominal fringe; two rows of enlarged scales on tail; ventral scales of medium size, imbricate, smooth; femoral pores 15-15, rows separated mesially by five preanal scales.

Dorsal ground color gray to dark gray; nuchal blotches indistinct; dorsal dark spots fading into ground color, bordered by a lighter color only on posterior side; several pairs of indistinct dark spots on tail, these becoming transverse bars toward tip; head brownish gray with a few black flecks on frontal area; ventral scales cream, sparsely flecked with black.

Variation: The variation in this form is exceedingly great. Individuals can be found well within the geographic range of this subspecies, which resemble those of any one of the other subspecies of *douglassii.* A majority of the specimens, however, agree generally with specimens from the type locality. The rostrum varies from the typical blunt condition with the nostrils directed somewhat forward to a more pointed rostrum with lateral nostrils. The occipital spines vary in size and the direction in which they project from the skull. The dark dorsal spots may be edged with light scales posteriorly or they may be entirely absent. In the part of the range meeting that of *ornatissimum,* a few of the spots will have light mesial borders.

Discussion: This subspecies is most closely related to *P. d. ornatissimum* as is shown best in the characteristics of the occipital and temporal regions of the head. The temporal spines are short and usually project upward. Their lateral profile closely resembles that of *ornatissimum,* as does the thick expanded appearance of the lateral temporal area. The occipital spines are equivalent to those of *ornatissimum* in size, shape, the angle at which they are attached to the skull, and the interoccipital distance between them. The differences in the two lies in the smaller size of *brevirostre,* the reduction of the white borders of the dorsal spots and the general "faded" condition of the dorsal pattern as a whole.

Locality records: Colorado. *Boulder Co.:* Boulder (USNM 34569-70). *Denver Co.:* Denver (USNM 30915-20, 29601). *El Paso Co.:* Colorado Springs (USNM 8444, 5 spec., 9263, 8514); *La Plata Co.:* no specific locality (USNM 35469). *Moffet Co.:* Lay (USNM 40141); Snake River (USNM 40144). *Weld Co.:* no specific locality (KU 23571-72); Greeley (USNM 37035); Avalo (USNM 40139). *Morgan Co.:* no specific locality (KU 370-371).

Kansas. *Edwards Co.:* no specific locality (Burt, 1928). *Ellis Co.:* Fort Hays (Brennan, 1934). *Geary Co.:* Ft. Riley (USNM 4612). *Logan Co.:* no specific locality (KU 366), (AMNH 36911). *Rooks Co.:* no specific locality (Burt, 1928). *Smith Co.:* no specific locality (KU 506).

Montana. *Chouteau Co.:* Fort Benton (USNM 9414). *Gallatin Co.:* Gallatin Station (USNM 17415); Logan (USNM 32652), no specific locality (USNM 14641). *Garfield Co.:* Cohagen, 25 mi. SW (USNM 44931). *Golden Valley Co.:* Painted Robe (USNM 45299). *Hill Co.:* Milk River at Lat. 49° (USNM 1148). *Prairie Co.:* Terry 25 mi. N (USNM 44931). *Richmond Co.:* Mouth of Yellowstone River (USNM 9198). *Rosebud Co.:* Rosebud Creek (USNM 45300-301). *Yellowstone Co.:* Billings (USNM 44705, 44929-30), East Pryor Creek (USNM 28443-45), Fort Custer (USNM 14523).

Nebraska. *Box Butte Co.:* Hemingford (NSM R151-157, R358-359, 983, 1081), 5 mi. N (NSM R311-312); no specific locality (KU 21451-52). *Cherry Co.:* Valentine, 3 mi. SE (Burt & Hoyle, 1934).* *Cheyenne Co.:* Sidney (USNM 10786). *Dawes Co.:* Crawford (NSM 1190-92); Dunlap, 14 mi. W (AMNH 60054-58); Wayside

* Hudson, 1942, p. 37 corrects this record, stating that the specimen actually came from Sioux County.

(KU 23082). *Kimball Co.:* Dix (NSM R354-357); Pole Creek (= Lodge Pole Creek) (USNM 208). *Scottsbluff Co.:* Gering (AMNH 64738-40). *Sheridan Co.:* Hay Springs (AMNH 58966, 60296), 12 mi. SW (NSM 429). *Sioux Co.:* Agate (NSM R168-170, R310); Andrews (NSM R143-147); Henry, 18 mi. N (NSM R220); Niobrara River (AMNH 64714, 64751-57), 9 mi. N (AMNH 64750); Orella (NSM 1189).

SOUTH DAKOTA. *Fall River Co.:* Ardmore (USNM 63047). *Harding Co.:* Crow Buttes (Over, 1923). *Shannon Co.:* Wounded Knee Creek (Over, 1923). *Washington Co.:* Wounded Knee Creek (Over, 1923).

NORTH DAKOTA. *Billings Co.:* Peaceful Valley Ranch (Wheeler, 1947); near Medora (Wheeler, 1947); Mikkelson (Wheeler, 1947). *Golden Valley Co.:* Beach (Wheeler, 1947). *McKenzie Co.:* "40 miles N of Sentinel Butte" (Wheeler, 1947).

WYOMING. *Big Horn Co.:* Burlington (USNM 48181-82). *Carbon Co.:* Fort Steele (USNM 48154); Saratoga (USNM 48110-11); 12 mi. N (AMNH 58842). *Fremont Co.:* Washakie (USNM 44788-92). *Goshen Co.:* Fort Laramie (USNM 4604, 2 spec.). *Park Co.:* Cody (USNM 48178-80). *Platte Co.:* Cassa (USNM 40190). *Natrona Co.:* Powderville (USNM 54591-93). *Sheridan Co.:* Sheridan (USNM 47704). *Hot Springs Co.:* Owl Creek Mountains (USNM 48122-23). *Sweetwater Co.:* Bitter Creek, 18 mi. S (KU 23091), 24 mi. S (AMNH 46994); Black Rock Butte (USNM 49666); Green River (Stone, 1911). *Uinta Co.:* Bridger Pass (USNM 9313, 9308, 16018); Evanston, 14 mi. N (USNM 48686); Fort Bridger (USNM 47703, 5455, 44913); 8½ mi. W (KU 23594); Weston, 23 mi. SW (KU 23680-81). *Washakie Co.:* Ten Sleep, 20 mi. W (USNM 48183-84, 48124).

Phrynosoma douglassii brachycercum Smith

Phrynosoma douglassii brachycercum Smith, Proc. U. S. Nat. Mus., vol. 92, 1942, pp. 362-363; Smith, Trans. Kansas Acad. Sci., vol. 48, 1945, p. 338; Smith & Taylor, Univ. Kansas Sci. Bull., vol. 33, pt. 2, pp. 330, 375; Bull. U. S. Nat. Mus., no. 199, p. 100.

Taxonomic history: Smith (1942:362) named this form from specimens in the United States National Museum, taken in Durango, Mexico by Dr. Edward Palmer.

Smith's diagnosis and description are repeated here:

Diagnosis: "Similar to *Phrynosoma douglassii*, but with a tail shorter than head is wide or in adults, very slightly longer; gular scales in straight rows slightly diverging posteriorly, the scales small

and tubercular (strongly convex), not flat; chest scales keeled; horns of head very short, postorbitals, temporals, and occipitals subequal in size.

"Description of holotype.—Head a broad, short, conventionalized heart-shape in profile; in lateral profile, postorbital spine highest, supraocular and internasal areas forming an obtuse angle with each other (not a curve); width of head (26.2 mm.) at widest point in temporal region much greater than length of head from snout to occiput (15.6 mm.) or to posterior tip of temporal spine (21 mm., in a projected straight line); supraocular [frontal] region flat, with no enlarged scales; posterior border of supraocular [frontal] region strongly indented medially, marked by a series of enlarged, slightly protuberant scales; each series begins at postorbital [superciliary] spine and extends anteriomedially, but fails to reach its mate by 1 scale; postorbital [superciliary], occipital, and temporal spines subequal in size; 5 scales between occipital spines; 2 small, flat spines, separated from each other by a scale, preceding occiput; 3 subequal temporal spines, the posterior slightly separate from others, the series continuing anteriorly as a row of enlarged scales, disappearing below about the middle of the eye.

"Three posterior infralabials [postlabials] considerably enlarged, keeled scales [chinshields] in contact with a few infralabials anteriorly but separated throughout the remainder of its length by one to three rows of small scales; gulars in very definite, straight rows slightly diverging posteriorly; these scales not flat, but small and convex (tubercular); in extreme posteriolateral portion of throat the scales are strongly protuberant and conical, and have no free lateral edges.

"An irregular series of preauricular spines; tympanum exposed; a large skin fold anterior to lateral nuchal pocket, and a small one posteriorly, the former surmounted by two series of spines, the latter by one or two spines; a small, vertical series of spines in front of the above arm insertion.

"All dorsals keeled, imbricate (except enlarged spines), not granular; among these are scattered, enlarged keeled spines of varying size, diminishing laterally; a single row of lateral spines (fringe); in the posterior part of the fringe the spines are separated from each other, while anteriorly they are in contact; spines on tail few, small; tail very broad at base, but remainder very slender, not tapering into base; eight longitudinal series of spines at base of tail.

"Scales on chest rather distinctly keeled; remainder of ventral

scales smooth; femoral pores 16-18; 14-16 lamellae under fourth toe. Total length 80 mm.; tail 24 mm.

"Head slightly reddish; body dirty straw yellow, with transverse, medium, dusky (gray) crossbands; limbs feebly barred; throat, chest, and sides of abdomen with small, round scattered dark spots."

Discussion: Besides the holotype (USNM 23993) and three topotypic paratypes (USNM 23994-96), nine additional specimens (AMNH 68229, 68271-68272, 68964-68968), (KU 28068) have been collected. The American Museum specimens are from the vicinity of Santa Bárbara, Chihuahua, Mexico. In the major distinctive characters these specimens fit perfectly the description of this subspecies. The length of the tail does not exceed the width of the head in any specimen by more than four millimeters; in two, its length is less than, and in two others equal to, the width of the head. The University of Kansas specimen was collected by Mr. Ray Alcorn on June 20, 1950, and arrived at the Natural History Museum on July 4, 1950. The color and color pattern were still clearly evident. The "reddish" color observed on the head of the type was present on this specimen and occurred also as the ground color of the dorsum of the body. The inner surface of the lips was a bright reddish orange. The scales of the abdomen appear to have been bright pink.

The Kansas University specimen was taken five miles north of Durango (city), Durango, Mexico, which suggests that Durango (city) was the place from which Doctor Palmer collected the type specimens. In view of this I restrict the type locality to Durango (city), Durango, Mexico.

Locality records: MEXICO. *Durango:* Durango 5 mi. N (KU 28068); no specific locality (USNM 23993-23996), (AMNH 1308). *Chihuahua:* Santa Bárbara (AMNH 68229, 68271-68272, 68964-68968).

Phrynosoma douglassii douglassii (Bell)

Agama douglassii Bell, Trans. Linn. Soc. London, vol. 16, 1828, (1833), pp. 105-107, pl. 10; Harlan, Med. and Phys. Researches, 1835, p. 141, fig. 3.

Phrynosoma douglassii Wagler, Natural Syst. Amph., 1830, p. 146; Gray, In Griffith's Cuvier's Animal Kingdom, vol. 9, 1831, p. 44; Wiegmann, Herpetologia Mexicana, 1834, p. 54; Duméril & Bibron, Érpétologie Générale ou Histoire Naturelle . . ., vol. 4, 1837, p. 323; Holbrook, North American Herpetology, 1 ed., vol. 3, 1838, p. 69, pl. 12, and *idem*, 2 ed., vol. 2, 1943, p. 101, pl. 14; Dekay, Zoology of New York, vol. 3, 1942, p. 31; Fitzinger, Systema Reptilium, 1843, p. 78; Gray, Catalogue of the Lizards in the British Museum of Natural History, 1845, p. 227; Duméril & Duméril, Catalogue Methodique de la Collection des Reptiles du Museum d'Histoire Naturelle, Paris, 1851, pp. 78-80; Cooper, Amer. Nat. vol. 3, 1869, p. 298; Hoffman, Amer. Nat. vol. 13, 1879, pp. 326-327; Boulenger, Catalogue of The Lizards

in the British Museum of Natural History, vol. 2, 1885, p. 240 (*part.*); Gentry, Proc. Acad. Nat. Sci. Philadelphia, 1885, p. 140 (*part.*); Stejneger, N. Amer. Fauna, no. 5, 1891, pp. 109-113; Van Denburgh, Occas. Papers California Acad. Sci., no. 5, 1897, p. 90 (*part.*); Van Denburgh, Proc. California Acad. Sci., ser. 4, vol. 3, 1912, p. 156 (*part.*); Stejneger & Barbour, Check List of the North American Amphibians and Reptiles, 1917, p. 59; Van Denburgh & Slevin, Proc. California Acad. Sci., ser. 4, vol. 11, 1921, pp. 40, 43; McLain, Critical Notes on a Collection of Reptiles from the West Coast of North America, 1899; Gadow, Proc. Zool. Soc. London, 1905, p. 213; Ditmars, Reptiles of the World, 1910, pp. 150-151.

Tapaya douglassii Girard, United States Exploring Expedition for the years 1838, 1839, 1840, 1841, 1842 under the Command of Charles Wilkes, USN. 1858, p. 398 (*part.*); Baird, Report of Exploration and Survey for a Rail Road Route from Sacramento Valley to the Columbia River, 1859; Baird, Report of the Pacific Rail Road Survey, vol. 12, 1860, p. 294; Cooper & Suckley, Report of the Pacific Rail Road Surveys, vol. 12, 1860, p. 294; Cooper & Suckley, Natural History of the Washington Territory, 1860, p. 294; Lord, Naturalist Vancouver Island, vol. 2, 1866, p. 302; Aug. Duméril and Bocourt, Mission Scientifique au Mexique et dans l'Amérique Centrale, Études sur les Reptiles, livr. 1, 1870, pl. 11, fig. 5, and Bocourt, *idem*, livr. 4, 1874, pp. 226-227, pl. 11, fig. 5a-5f.

Phrynosoma douglassii exilis Cope, Ann. Rept. U. S. Geol. Surv. Terrs., 1871, p. 468.

Phrynosoma douglassii douglassii Cope, Bull. U. S. Nat. Mus., no. 1, 1875, p. 49 (*part.*); Cope, Amer. Nat., vol. 13, 1879, p. 435; Cope, Report U. S. Nat. Mus., for 1898 (1900), p. 411, fig. 69 (*part.*); Dice, Univ. California Publ. Zool. vol. 16, 1916, pp. 300-301.

Phrynosoma douglassii pygmaea Yarrow, Proc. U. S. Nat. Mus., vol. 5, 1882, p. 443; Yarrow, Bull. U. S. Nat. Mus., no. 24, 1883, p. 70; Townsend, Proc. U. S. Nat. Mus., vol. 10, 1887, p. 238; Stejneger, N. Amer. Fauna, no. 3, 1890, pp. 112-113.

Phrynosoma douglassii hernandesi Cope, Ann. Report U. S. Nat. Mus. for 1898 (1900), p. 413 (*part.*).

Phrynosoma douglassii douglassii Bryant, Univ. California Publ. Zool., vol. 9, 1911, pp. 5, 22, pl. 3 (*part.*); Grinnell & Camp, Univ. California Publ. Zool., vol. 17, 1917, p. 164; Van Denburgh, Occas. Papers California Acad. Sci., no. 10, 1922, pp. 368-377; Stejneger & Barbour, Check List of the North American Amphibians and Reptiles, 2 ed., 1923, p. 61; Erwin, The Eleventh Biennial Report of the Board of Trustees of the State Historical Society of Idaho, 1928, p. 32; Stejneger & Barbour, Check List of North American Amphibians and Reptiles, 3 ed., 1933, p. 67; Svihla & Svihla, Copeia, no. 1, 1933, p. 127; Gordon, Oregon St. Mono., Studies in Zool., no. 1, 1939, pp. 12, 15, 47-48, figs. 43, 44; Stejneger & Barbour Check List of North American Amphibians and Reptiles, 4 ed., 1939, p. 74; Graf, Jewett & Gordon, Copeia, no. 2, 1939, p. 103; Owen, Copeia, no. 3, 1940, p. 170; Anderson & Slater, Occas. Papers Dept. Biol. Coll. Puget Sound, no. 15, 1941, p. 111; Driver, Name That Animal, 1942, p. 348; Evender, Copeia, no. 4, 1946, p. 257.

Phrynosoma brevirostre Stone, Proc. Acad. Nat. Sci. Philadelphia, 1911, p. 229 (*part.*).

Phrynosoma orbiculare douglassii Klauber, Bull. Zool. Soc. San Diego, vol. 4, 1939, pp. 91-93; Stejneger & Barbour, Bull. Mus. Comp. Zool. Harvard Coll., vol. 93, 1943, p. 94.

Taxonomic history: The type description of this form was made by Bell (1829) from specimens in the British Museum, collected by Douglass in the Columbia River Area. Bell placed this animal in the genus *Agama*. The paper was read before the Linnean Society of London the same year, and published in volume 16 of the

Transactions of the Linnean Society of London in 1829. Wagler (1830) and Gray (1831) both placed it in *Phrynosoma*. Cope (1875) reduced it to subspecific rank, referring to it as *Phrynosoma douglassii douglassii*.

Diagnosis: Size small, rarely exceeding 125 mm.; occipital and temporal spines minute, projecting vertically; ground color generally dark brown or dark blue.

Description: Head broader than long; frontal area flat, covered with small, irregular, rugose scales; superciliary ridges distinct terminating posteriorly in a slightly enlarged blunt spine; nostrils small, on canthal line, separated by a distance equal to three and one-half to four times diameter of a single nostril; supralabials small, inconspicuous; infralabials small, increasing in size posteriorly to angle of jaw, continuous with postlabials; four postlabials, penultimate largest; chinshields only slightly enlarged, separated from infralabials by three small sublabials; gular scales subequal; two lateral neck patches of enlarged, soft spines borne on folds of skin, upper patch largest; occipital spines reduced to short vertical tubercles; interoccipital distance approximately three times basal diameter of spine; temporal shelf expanded, bearing several small, inconspicuous spines; dorsal scales of irregular size, largest keeled and set in a rosette of smaller, keeled scales; one row of soft spines in lateral abdominal fringe; tail short, covered with irregular scales; ventral scales smooth throughout; femoral pores 17-17, rows separated mesially by six preanal scales.

Dorsal ground color dark blue-gray; nuchal blotches black, indistinct; four pairs of dark brown to black spots on each side of back between neck and rump; spots usually outlined posteriorly in lighter color; one pair of spots on base of tail, four transverse bands on tail; head greenish gray with black flecks on tips of scales; ventral scales gray with scattered black flecks.

Variation: The chief variation in this subspecies is in the ground color, which ranges from dark gray to brownish or to dark yellow. The colors usually appear to be faded and are dull. The dorsal spots are usually edged posteriorly in a lighter color but in some individuals these blend with the ground color.

Discussion: This is one of the smallest forms of the species, rarely exceeding 70 mm. in snout-vent measurement. Specimens from the lava areas of Idaho tend to be much darker, often being dark gray or even black.

General distribution: This subspecies occurs in the northwestern part of the United States in the states of Washington, Oregon, Idaho and the northern parts of California and Nevada.

Locality records: Washington. *Kittitas Co.:* Ellensburg (Owen, 1940). *Okanogan Co.:* Pateros (Owen, 1940). *Pierce Co.:* Fort Steilcoon (USNM 9199); Puget Sound (USNM 217). *Sherman Co.:* Grant (Van Denburgh, 1897). *Spokane Co.:* (MVZ 43505-06). *Walla Walla Co.:* Walla Walla (USNM 10918, 5 spec.). *Whitman Co.:* Almota (Svihla & Svihla, 1933); Rock Lake (Svihla & Svihla, 1933). *Yakima Co.:* Selah (Owen, 1940); North Yakima (Van Denburgh, 1897).

Oregon. *Crook Co.:* Buck Creek (USNM 44974); Prineville (USNM 44907). *Deschutes Co.:* Deschutes (USNM 11473). *Gillian Co.:* Arlington (Gordon, 1939). *Harney Co.:* Burns (Gordon, 1939); Voltage (USNM 63264-65); Wagon Tire (Anderson & Slater, 1941). *Klamath Co.:* Klamath Falls (USNM 59288); Klamath Lake (Baird, 1859). *Lake Co.:* Chewauacan Valley, Olive (USNM 25911), between Warners and Goose Lakes (USNM 25912-13); Plush (USNM 25909-10), between Plush and Blue Creek (USNM 25925-33); Silver Lake Desert (MVZ 14990). *Linn Co.:* Sand Mountain (Graf, Jewett, & Gordon, 1939). *Morrow Co.:* Butler Creek, North Fork (Anderson & Slater, 1941); Heppner (USNM 44971-73). *Umatilla Co.:* Harmiston (Gordon, 1939); Holdman (Gordon, 1939); Cold Springs Landing, 5 mi. S (MVZ 16799). *Wasco Co.:* Antelope (USNM 45186).

California. *Modoc Co.:* Clear Lake (USNM 45138). *Siskiyou Co.:* Mount Shasta west base (USNM 12792, 2 spec.).

Idaho. *Ada Co.:* Boise (USNM 63266). *Bannock Co.:* Pocatello (USNM 48665). *Bingham Co.:* Aberdeen (UU 180, 177, 181); Blackfoot (USNM 16771); Fort Hall (Van Denburgh, 1922). *Butte Co.:* Big Butte (USNM 16772-73). *Butte* and *Custer Cos.:* Big Lost River (USNM 16318-19, 16774-75). *Cassia Co.:* Cottonwood Creek (McLain, 1899). *Elmore Co.:* Mountain Home (Evender, 1946). *Fremont Co.:* Elgin (BYU 8178). *Lemhi Co.:* Birch Creek, head of (USNM 16315-17). *Lincoln Co.:* Shoshone (McLain, 1899 listed as Logan Co.). *Madison Co.:* Rexburg (BYU 8054). *Nez Perce Co.:* Clearwater, 7 mi. above Lewiston (USNM 21473). *Owyhee Co.:* Little Owyhee River, 7 mi. N Nevada line (MVZ 24509-10), 10 mi. N Nevada line (MVZ 24517), 11 mi. N Nevada line (MVZ 24508).

NEVADA. *Elko Co.:* Bull Run Mountains (USNM 44816); Mountain City (Linsdale, 1940), 6 mi. S (Linsdale, 1940). *Humboldt Co.:* Martin Creek (Linsdale, 1940); Santa Rosa Mountains (Linsdale, 1940).

Phrynosoma douglassii hernandesi Girard

Phrynosoma orbiculare Hallowell, *in* Sitgreaves' Expedition down the Zuni and Colorado Rivers, 1863, p. 125, pls. 8, 9.

Tapaya hernandesi Girard, United States Exploring Expedition for the years 1838, 1839, 1840, 1841, 1842, under the command of Charles Wilkes, USN, vol. 20, Herpetology, 1858, p. 395. *Tapaya* used as a subgenus.

Tapaya hernandezii Baird, United States Mexican Boundary Survey, under the Order of Lieut. Col. W. H. Emory, Reptiles of the Boundary, vol. 2, 1859, p. 38; Bocourt, Mission Scientifique au Mexique et dans l'Amérique Centrale, Études sur les Reptiles, livr. 4, 1874, p. 228.

Tapaya ornatissima Garman, Bull. Essex Inst. vol. 16-18, 1884.

Phrynosoma douglassii Cope, Proc. Acad. Nat. Sci. Philadelphia, 1866, p. 302; Coues, Report of the Geography and Geology of the Survey West of the 100th Meridian, under Lt. Wheeler, vol. 5, Zoology, 1875, p. 591 (*part.*); Cope, Proc. Acad. Nat. Sci. Philadelphia, 1883, p. 12; Boulenger, Catalogue of the Lizards in the British Museum of Natural History, vol. 2, 1885, p. 240, (*part.*); Gentry, Proc. Acad. Nat. Sci. Philadelphia, 1885, p. 140 (*part.*); Herrick, Terry & Herrick, Bull. Sci. Lab. Denison Univ., vol. 11, 1889, p. 134; Herrick, Terry & Herrick, Bull. Univ. New Mexico, vol. 1, 1899, p. 134, pl. 18, fig. 15; Lampe, Jahrb. Nassau. Ver. Naturk., vol. 64, 1911, p. 164; Eaton, Copeia, 1935, p. 151 (*part.*).

Phrynosoma hernandezii Cope, Bull. U. S. Nat. Mus., no. 1, 1875, p. 49; Yarrow, Report of the Geography and Geology of the Survey West of the 100th Meridian, under Lt. Wheeler, vol. 5, Zoology, 1875, p. 577; Yarrow, Bull. U. S. Nat. Mus., no. 24, 1883, p. 68 (*part.*); Cockerell, Amer. Nat. vol. 30, 1896, p. 227 (*part.*); McLain, Critical Notes on a Collection of Reptiles from the West Coast of North America, 1899, p. 8; Stone, Proc. Acad. Nat. Sci. Philadelphia, 1911, p. 229 (*part.*).

Phrynosoma douglassii ornatissimum Cope, Bull. U. S. Nat. Mus., no. 1, 1875, p. 49; Yarrow, Report of the Geography and Geology of the Surveys West of the 100th Meridian under Lt. Wheeler, vol. 5, Zoology, 1875, pp. 577-581 (*part.*); Cope, Report U. S. Nat. Mus. for 1898, (1900), p. 415, fig. 71 (*part.*); Strecker, Baylor Bull. vol. 18, 1915, p. 22; Weese, Biol. Bull., vol. 32, 1917, pp. 98-116.

Phrynosoma douglassii douglassii Yarrow, Report of the Geography and Geology of the Surveys West of the 100th Meridian, under Lt. Wheeler, vol. 5, Zoology 1875, p. 580 (*part.*); Yarrow, Bull. U. S. Nat. Mus., no. 24, 1883, p. 68 (*part.*); Cope, Report U. S. Nat. Mus. for 1898, (1900), p. 111 (*part.*); Bryant, Univ. California Publ. Zool., vol. 9, 1911, p. 7.

Phrynosoma hernandesi Stejneger, N. Amer. Fauna, no. 3, 1890, p. 112, pl. 12, figs. 4a-c (*part.*); Van Denburgh, Proc. California Acad. Sci., ser. 2, vol. 6, 1896, p. 342; Stejneger, Proc. U. S. Nat. Mus., vol. 25, 1902, p. 151; Bailey, N. Amer. Fauna, no. 25, 1905, pp. 35, 43; Ruthven, Bull. Amer. Mus. Nat. Hist., vol. 23, 1907, pp. 542-544; Van Denburgh & Slevin, Proc. California Acad. Sci., ser. 4, vol. 3, 1913, pp. 397, 405; Stejneger & Barbour, Check List of North American Amphibians and Reptiles, 1917, p. 59 (*part.*); Van Denburgh, Occas. Papers California Acad. Sci., no. 10, vol. 1, 1922, pp. 382-385, pl. 31; Cuesta Terron, Ann. Inst. Biol., vol. 3, 1932, pp. 97-99; fig. 1; Little, Copeia, 1940, p. 263.

Phrynosoma douglassii hernandesi Cope, Report U. S. Nat. Mus. for 1898 (1900), p. 413, fig. 70 (*part.*); Stone & Rehn, Proc. Acad. Nat. Sci. Philadelphia, 1903, p. 32; Ditmars, The Reptile Book, 1907, p. 149, pl. 47, fig. 3 (*part.*); Strecker, Proc. Biol. Soc. Washington, vol. 21, 1908, pp. 165-166;

Ditmars, Reptiles of the World, 1910, pp. 150-151 (*part.*); Bryant, Univ. California Publ. Zool., vol. 9, 1911, p. 5; Ellis & Henderson, Univ. Colorado Studies, vol. 10, pp. 72-74, pl. 3, figs. 12, 14; Strecker, Baylor Bull., vol. 18, 1915, pp. 23-25; Stejneger & Barbour, Check List of North American Amphibians and Reptiles, 2 ed., 1923, pp. 61-62; Van Denburgh, Proc. California Acad. Sci., ser. 4, vol. 13, 1924, pp. 191-209; King, Copeia, 1932, p. 177; Mosauer, Occas. Papers Mus. Zool. Univ. Michigan, no. 246, 1932, p. 9; Burt, Amer. Midl. Nat., vol. 14, 1933, pp. 244-245; Stejneger & Barbour, Check List of North American Amphibians and Reptiles, 3 ed., 1933, pp. 67-68; Smith, Trans. Kansas Acad. Sci., vol. 37, 1934, p. 287; McKee & Bogert, Copeia, 1934, p. 179; Burt, Amer. Midl. Nat., vol. 16, 1936, p. 324 (*part.*); Quaintance, Copeia, 1935, p. 184; Burt, Trans. Kansas Acad. Sci., vol. 38, 1936, p. 261; Gloyd, Bull. Chicago Acad. Sci., vol. 5, 1937, p. 113; Dodge, Bull. Grand Canyon Nat. Hist. Assoc., no. 9, 1938, pp. 31-33; Stejneger & Barbour, Check List of North American Amphibians and Reptiles, 4 ed., 1939, p. 73; Klauber, Bull. Zool. Soc. San Diego, no. 14, 1939, pp. 91-93; Tanner, Great Basin Nat., vol. 1, 1940, p. 141; Smith, Copeia, 1941, p. 114; Smith & Laufe, Trans. Kansas Acad. Sci., vol. 48, 1945, p. 338; Lowe, Herpetologia, 1947, p. 37; Smith & Taylor, Univ. Kansas Sci. Bull., vol. 33, pt. 2, 1950, pp. 359-375; Bull. U. S. Nat. Mus., no. 199, 1950, p. 100.

Phrynosoma orbiculare hernandesi Klauber, Bull. Zool. Soc. San Diego, Bull. 14, 1939, pp. 91-93; Kauffeld, Amer. Midl. Nat., vol. 29, 1943, p. 345; Stejneger & Barbour, Bull. Mus. Comp. Zool. Harvard Coll., vol. 93, 1943, p. 94; Marr, Amer. Midl. Nat. vol. 32, 1944, p. 482.

Taxonomic history: This subspecies was first described by Girard (1858) as [*Phrynosoma*] (*Tapaya*) *hernandesi, Tapaya* being a subspecies under *Phrynosoma.* This actual combination does not appear, but it must be inferred. The specimens on which Girard based the description were not listed in his treatise. Stejneger (1890) designated USNM nos. 107 and 198 as the type specimens of Girard's *Tapaya hernandesi.* Inasmuch as the specimens bearing USNM no. 107 are of another species and since USNM no. 197 is listed on the Museum's type cards as the type specimen of *hernandesi,* I believe that USNM no. 107 as used in Stejneger's treatise is a misprint for number 197. Smith and Taylor (1950 a), believing that Stejneger's number 107 was intended for 197, have designated USNM no. 197 as the type specimen of *Phrynosoma douglassii hernandesi* and have restricted the type locality to Santa Fe, New Mexico. Actually the specimen bearing the tag no. 197 was collected by J. D. Graham and J. H. Clark in 1857, in Sonora. The tag bears no further data, but realizing that the Gadsden purchase was consummated in 1853 and that these men were with a Geological Survey Party, they must have been cognizant of the boundary. Therefore, I believe that "Sonora," as listed for no. 197, must be interpreted as the State of Sonora, Mexico. On the other hand, the tag bearing the USNM no. 198 and the locality Santa Fe, New Mexico, is loose in a jar with a specimen of *Phrynosoma douglassii hernandesi* which has attached to it a metal tag carrying the number 3034. Number 3034 must refer to some other collection,

since USNM no. 3034 is the type specimen of *Cnemidophorus gracilis.* Furthermore the specimen in the jar with the tag no. 198 agrees more closely with specimens of *Phrynosoma douglassii hernandesi* from southern Arizona, than it does with specimens of *Phrynosoma douglassii ornatissimum,* the only form positively known to occur at Santa Fe.

In view of the above facts I propose to regard USNM no. 197 as the type of *Phrynosoma douglassii hernandesi,* the type locality, however, being [the state of] Sonora, Mexico. When specimens are at hand from specific localities in northern Sonora, the locality should be restricted.

Diagnosis: Temporal spines long, each as long as, or longer than, its basal diameter; width of head at temporal region as wide as, or wider than, head at angle of jaws; dorsal spots bordered only posteriorly by light scales; tail more than one and one-half times width of head.

Description: Head broader than long; frontal area slightly concave, covered with small, irregular, rugose scales; superciliary ridges distinct, terminating posteriorly in triangular medium-sized spine; latter subequal in length to occipital spine; nostrils small, on canthal lines, separated by a distance equal to four or five times diameter of one nostril; nostrils entering from lateral surface of snout; supralabials small inconspicuous; infralabials increasing in size posteriorly; four postlabials markedly enlarged, continuous with infralabials; chinshields enlarged only slightly, separated from infralabials by a maximum of three sublabials; gular scales equal; two lateral neck patches of slightly enlarged flexible spines, lower patch reduced and joining upper patch at about its center; tympanum exposed; occipital shelf bearing several small tubercles; occipital spines small, widely separated usually directed posteriorly; interoccipital distance approximately three to three and one-half times basal diameter of one spine; temporal area expanded, extending lateroposteriorly; three temporal spines project posteriorly from posterior angle of temporal area; smallest temporal spine equal to, or larger than, occipital spine; lateral profile of temporal horns form straight line directed at first postlabial; dorsal scales small, imbricate, smooth, interrupted by numerous enlarged keeled scales; enlarged scales arranged in eight indistinct longitudinal rows, which decrease to four on rump and on the base of tail and to two on tail; one row of enlarged soft spines in lateral abdominal fringe; ventral

scales small, imbricate, smooth; femoral pores 15-16, rows separated mesially by three preanal scales.

Dorsal ground color gray; nuchal blotches brown to black; three pairs indistinct dark blotches spaced equally between neck and rump; blotches may alternate, several transverse bars on tail; head gray, temporal areas and spines cream, ventral scales cream with dark gray to black spots.

Variation: The texture of the dorsal scalation varies from a nearly uniformly smooth condition in specimens from southern Arizona to a rough bristly appearance in those from southern Utah. The distinctness of the dorsal pattern is variable, appearing as indistinct dark transverse bands without indication of a light posterior border or as somewhat distinct blotches with cresent shaped, light posterior borders. The blotches or bars may be either opposite or staggered in arrangement. The temporal areas of the head are usually of a color different from that of the remainder of the head, often being reddish or cream colored.

Discussion: This subspecies is most easily distinguished from *ornatissimum* by the character and color of the temporal area and spines. Any temporal spine of *hernandesi* is at least as long as the base is wide and often longer; they project posteriorly in uniform order. In *ornatissimum* the basal diameter nearly always exceeds the length of the spine. The spines in turn project upward in a somewhat irregular manner. In the latter form the width of the head at the angle of the jaws exceeds the width of the temporal area quite noticeably, whereas in *hernandesi* the width at the temporal area is equal to, and often exceeds, that at the angle of the jaws.

The dorsal pattern is quite characteristic in the two forms. The dorsal spots in *ornatissimum* are bordered both posteriorly and mesially in a light color; thus the spots are distinct whereas in *hernandesi,* at most, only the posterior limits of the spots are bordered and often there is no border at all.

Locality records: Arizona. *Cochise Co.*: Apache (USNM 8255-56, 8257, 8575); Fort Huachuca (USNM 42136, 22316, 17783-84, 19681-83, 32232-34, 18009, 21727); Lowell (USNM 8452, 5 spec., 8513); San Pedro River (USNM 21022-26). *Coconino Co.*: Grand Canyon (USNM 79686, 59838, 44629); Flagstaff (UU 207), (USNM 82000, 60173), (KU 383-85, 388-89, 381-83, 393); House Rock Station, 25 mi. S (KU 22231-35); House Rock Springs (USNM 44625), Kaibab Forest (UU 130-33, 197, 640, 459, 459a),

(USNM 79954, 71237-38); Little Colorado River (USNM 4599, 4580), Little Colorado Desert (USNM 15815); Painted Desert (USNM 15816-19); San Francisco Mountains (USNM 16198, 15802, 15799-814), (MVZ 8668, 6872, 8688); Stoneman Lake (USNM 59835); Tuba City, 1 mi. S (UU 1500, 6 spec. young); Williams (USNM 73748); Winona (USNM 60177-79). *Gila Co.*: Payson, 23 mi. E (KU 22230); Pine (BYU 2897, 2372-73), Roosevelt Reservoir (USNM 104287-91); White River Canyon (USNM 10191); no specific locality (KU 12934). *Graham Co.*: Mt. Trumbull (USNM 44636, 54610), 7 mi. N (USNM 44630-31); Stanley (MVZ 12885). *Maricopa Co.*: Cave Creek (KU 11302). *Mohave Co.*: Hualpai mountains (USNM 60184-7, 44624). *Navajo Co.*: Bubbling Spring Canyon (AMNH 2362); Kayenta (BYU 8016); March Pass Camp (UU 2170), (MVZ 2362). *Pima Co.*: Mount Lemon (KU 6965-66); Rincon Mountains (USNM 39311-12, 48549); Santa Catalina Mountains (USNM 47937), (MVZ 12878); Tucson (USNM 13968). *Pinal Co.*: Oracle, 6 mi. SE (Gloyd, 1937). *Yavapai Co.*: Camp Verde (USNM 24580-81); Fort Whipple (USNM 11858, 11857, 11862); Mingus Mountain (USNM 59836-37); Prescott (USNM 15738, 38555); 3 mi. N (KU 22799); Prescott National Park, Mt. Hope (KU 20150-55); Seligman (USNM 39048), 30 mi. E (MVZ 8689).

COLORADO. *Mesa Co.*: Mack (USNM 40142).

NEW MEXICO. *Grant Co.*: Gila National Forest (UU 176), (USNM 47084); no specific locality (KU 15517).

UTAH. *Carbon Co.*: Price (UU 1380, 1391, 1379, 1381), (BYU 8031). *Emery Co.*: Wellington 6 mi. S (UU 1385, 1387-90). *Garfield Co.*: Aquarius Plateau (BYU 599, 1920-22); Bryce Canyon Nat. Park (UU 1838), (BYU 8055); Henry Mt. (UU 302-5, 141); Table Cliff Mountains (BYU 201, 110-17); Widtose, 7 mi. E (MVZ 12875). *Iron Co.*: Cedar City, 5 mi. W (KU 20675); Parowan Mountains (USNM 45195-96). *Kane Co.*: Duck Creek (UU 1700-05, 1707-14); Orderville (BYU 2821, 2185), 15 mi. N (BYU 8050); Skink Valley (UU 1677-78). *San Juan Co.*: Blanding, 35 mi. NW (UU 2030); La Sal Mountains (BYU 8015, 8017); Monticello, 5 mi. W (UU 2888). *San Pete Co.*: Fairview (BYU 2859); Maple Canyon (UU 306a, 307). *Washington Co.*: Enterprise, west of (BYU 8056-57); Kolob Mountain (BYU 3103); St. George (UU 373); Zion Nat. Park (UU 375).

MEXICO. *Chihuahua*: Ramos (Smith & Taylor, 1950b).

Phrynosoma douglassii ornatissimum Girard

Phrynosoma douglassii Girard, *in* Stansbury's Exploration and Survey of the Valley of Great Salt Lake of Utah, 1852, p. 362, pl. 7 figs. 6-9 (*part.*); Cope, Ann. Rept. U. S. Geol. Surv. Terrs., 1871, p. 467; Coues, Report of the Geography and Geology of the Survey West of the 100th Meridian under Lt. Wheeler, vol. 5, 1875, p. 591 (*part.*); Gentry, Proc. Acad. Nat. Sci. Philadelphia, 1885, p. 140 (*part.*); Stejneger, N. Amer. Fauna, no. 5, 1891, p. 109; Van Denburgh, Bull. U. S. Fish Commission for 1894, p. 56; Van Denburgh, Occas. Papers California Acad. Sci., no. 5, 1897, p. 90 (*part.*); McLain, Critical Notes on a Collection of Reptiles from the West Coast of North America, 1899, p. 8; Van Denburgh, Proc. California Acad. Sci., ser. 4, vol. 3, 1912, p. 156 (*part.*); Van Denburgh, & Slevin, Proc. California Acad. Sci., ser. 4, vol. 5, no. 4, 1915, p. 105; Van Denburgh & Slevin, Proc. California Acad. Sci., ser. 4, vol. 11, 1912, pp. 28, 40, 43.

Tapaya ornatissima Girard, United States Exploring Expedition for the years 1838, 1839, 1840, 1841, 1842 under the Command of Charles Wilkes USN, vol. 20, Herpetology, 1858, p. 396; Baird, United States Mexican Boundary Survey, vol. 2, Reptiles of the Boundary 1859, p. 9; Baird, Report of the Exploration and Surveys to Ascertain the most Practicable and Economic Rail Route to the Pacific Ocean, vol. 10, Reports upon the Reptiles of the Route, 1859, p. 38; Aug. Duméril & Bocourt, Mission Scientifique au Mexique et dans l'Amérique, Études sur les Reptiles, livr. 1, 1870, pl. 11, fig. 6 and Bocourt, *idem*, livr. 4, 1874, p. 227.

Phrynosoma douglassii douglassii Cope, Bull. U. S. Nat. Mus., no. 1, 1875, p. 49 (*part.*); Coues, Report of the Geography and Geology of the Survey West of the 100th Meridian under Lt. Wheeler, vol. 5, 1875, p. 580 (*part.*); Coues & Yarrow, Bull. U. S. Geol. Surv., vol. 4, 1878, p. 285; Yarrow, Bull. U. S. Nat. Mus., no. 24, 1883, p. 68 (*part.*); Cope, Rept. U. S. Nat. Mus., for 1898, (1900), p. 411 (*part.*); Bryant, Univ. California Publ. Zool., vol. 9, 1911, pp. 5, 22, pl. 3 (*part.*); Pack, Copeia, no. 63, 1918, p. 91.

Phrynosoma douglassii ornatissimum Yarrow, Report of Geography and Geology of the Survey West of the 100th Meridian, under Lt. Wheeler, vol. 5, 1875, p. 581 (*part.*); Yarrow, Bull. U. S. Nat. Mus., no. 24, pp. 11, 69; Cope, Report U. S. Nat. Mus., for 1898, (1900), p. 415, fig. 71 (*part.*); Ditmars, The Reptile Book, 1907, p. 148; Bryant, Univ. California Publ. Zool., vol. 9, 1911, p. 5; Van Denburgh, Occas. Papers California Acad. Sci., no. 10, 1922, vol. 1, pp. 377-380, pl. 30; Stejneger & Barbour, Check List of North American Amphibians and Reptiles, 2 ed., 1923, p. 62; Van Denburgh, Proc. California Acad. Sci., ser. 4, vol. 13, 1924, pp. 191-208; Stejneger & Barbour, Check List of North American Amphibians and Reptiles, 3 ed., 1933, p. 68 (*part.*); Stejneger & Barbour, Check List of North American Amphibians and Reptiles, 4 ed., 1939, p. 74 (*part.*); Stejneger & Barbour, Bull. Mus. Comp. Zool. Harvard Coll., vol. 93, 1934, p. 94, (*part.*).

Phrynosoma hernandesi Stejneger, N. Amer. Fauna, no. 3, 1890, p. 112 (*part.*); Cockerell, Science, ser. 2, vol. 14, 1901, p. 111; Cockerell, Univ. Colorado Studies, vol. 7, 1910, p. 131; Ellis & Henderson, Univ. Colorado Studies, vol. 10, 1913, p. 72, pl. 3, figs. 12, 14; Ruthven & Gaige, Occas. Papers Mus. Zool. Univ. Michigan, no. 8, 1915, p. 23.

Phrynosoma ornatissimum Stejneger, N. Amer. Fauna, no. 3, 1890, p. 115, pl. 12, figs. 3a-3c; Cary, N. Amer. Fauna, no. 33, 1911, pp. 21, 23, 26; Stejneger & Barbour, Check List of North American Amphibians and Reptiles, 1917, p. 60.

Phrynosoma douglassii hernandesi Cope, Report U. S. Nat. Mus., 1898 (1900), p. 413 (*part.*); Richardson, Proc. U. S. Nat. Mus., vol. 48, 1915, p. 423; Burt, Amer. Midl. Nat. vol. 14, 1933, pp. 244-45 (*part.*).

Phrynosoma douglassii brevirostre Stone, Proc. Acad. Nat. Sci. Philadelphia, 1911, p. 229 (*part.*).

Phrynosoma hernandesi ornatissimum Ellis & Henderson, Univ. Colorado Bull., vol. 15, 1915, p. 260.

Phrynosoma hernandesi hernandesi Ellis & Henderson, Univ. Colorado Bull., vol. 15, 1915, p. 260.
Phrynosoma douglassii ornatum Stejneger, Copeia, no. 65, 1919, p. 3.
Phrynosoma orbiculare ornatissimum Klauber, Bull. Zool. Soc. San Diego, no. 14, 1939, p. 93.

Taxonomic history: Girard (1858) described this subspecies as [*Phrynosoma*] *Tapaya ornatissima* on the basis of specimens in the United States National Museum. He gave the distribution as the Eastern Mountainous regions of New Mexico, but did not designate a type specimen. Yarrow (1875) was first to reduce it to subspecific status, *Phrynosoma douglassii ornatissimum.* Stejneger (1890) designated United States National Museum No. 204 (2 specimens) as the types used by Girard in making his description. These specimens were collected in the Zuni Mountains, New Mexico, by Woodhouse.

Diagnosis: Tail longer than head width; temporal spines shorter than their basal diameter; head width at angle of jaw exceeding that at temporal area; dorsal dark spots bordered mesially and posteriorly by a narrow light band.

Description: Head markedly wider than long; frontal area concave, covered with medium-sized, irregular, rugose scales; superciliary ridges distinct, terminating posteriorly in a blunt triangular spine; nostrils on canthal lines, medium sized; internasal distance equal to three times diameter of single nostril; supralabials small, inconspicuous; infralabials small, increasing in size posteriorly; three enlarged postlabials continuous with infralabials; chinshields small, increasing in size posteriorly, separated from infralabials by three sublabials; gular scales equal; two lateral neck patches of enlarged soft spines; lower patch connecting to center of upper patch; tympanum exposed; occipital area with several small tubercles; occipital spines small, shorter than their basal diameter, projecting upward; interoccipital distance equal to about twice diameter of single spine; temporal shelf moderately expanded; temporal spines small, length less than their basal diameter; lateral profile of temporal spines a curved line projecting to snout; dorsal scales small, imbricate, with enlarged keeled scales forming eight indistinct longitudinal rows; these reduced to four on rump and base of tail, with two continuing on tail; one row of enlarged, soft spines in lateral fringe; ventral scales medium size, imbricate, smooth; femoral pores 17-17, rows separated by four preanal scales:

Dorsal ground color light brown; nuchal blotches dark brown to black; three pairs of dark brown to black spots evenly spaced

between neck and rump, members of second and third pairs alternating; all spots outlined mesially and posteriorly in light cream; several indistinct markings on tail; head light brown; ventral scales cream with black spots scattered throughout.

Variation: The occipital spines vary somewhat in size and to some extent in the angle at which they are attached to the skull. They are rarely horizontal in position. The ground color varies to fit the substratum upon which the animal lives. The pattern, however, is constant, varying only in intensity.

Discussion: See *P. d. hernandesi.*

Locality records: Arizona. *Apache Co.:* Adamona (USNM 82309), (MVZ 9014-15); Chin Lee (USNM 60172, 44626); Ganado, 4 mi. NW (USNM 44627); Mt. Baldy (USNM 118590); St. John, 6-8 mi. S (MVZ 9016-17, 9021-22, 9024-27); White Mountains (USNM 9637); Zuni River (USNM 3219). *Greenlee Co.:* Eagle Creek (Quaintance, 1935).

Colorado. *Archuleta Co.:* Pagosa (USNM 11964, 8443). *Costillo Co.:* Garland (USNM 8558).

New Mexico. *Bernalillo Co.:* Albuquerque (USNM 8451, 2 spec.), (MVZ 5359-61), (KU 11308); Albuquerque, San Pedro Mountains (USNM 58419-22); Albuquerque, 20 mi. E (USNM 201). *Catron Co.:* Glenwood, 5 mi. NE (MVZ 42575); Mogollon, 10 mi. N (KU 6546), 8 mi. W (KU 6544); Quemado (USNM 44701). *Colfax Co.:* Cimarron (USNM 22666). *Grant Co.:* Mimbres Mountains (USNM 47089); Silver Creek (MVZ 42571-72), 7 mi. N (MVZ 42573); Silver City (USNM 4849), (MVZ 42568), (KU 15516-18), 12 mi. W (MVZ 42574). *Lincoln Co.:* Ruidoso (USNM 32992). *McKinley Co.:* Fort Wingate (USNM 14408, 14396); Zuni Mountain (USNM 44566). *Otero Co.:* Cloudcroft (USNM 32990); Guadalupe Mountains (32983-84); Mescalero (USNM 25433, 25434); Mescalero Reservation (USNM 32991). *Rio Arriba Co.:* Canjilon Ranger Station (MVZ 25219); Espanola (USNM 44886); El Rito, 4 mi. N (KU 11303-04, 11300-01). *San Miguel Co.:* Pecos (USNM 32989); Sacramento Mts., Sapello Canyon (Stone & Rehn, 1903); no specific locality (USNM 199). *Santa Fe Co.:* Glorieta (USNM 32988); Ildefonso (USNM 8445); San Pedro (USNM 32985-7); Santa Fe (USNM 9635, 3 spec. 8449, 4866, 4785, 2 spec.) (KU 11305-07, 6976), 8 mi. SW (KU 11288-97); Santa Fe Canyon (USNM 90902). *Socorro Co.:* No specific locality (KU 6720-21). *Taos Co.:* Rio Colorado (USNM 8450); Taos (USNM 8515). *Valencia Co.:* Grants (USNM 44805); Inscription Rock

(KU 11298-99); San Mateo Peak (USNM 44569-70); Zuni Mountains (USNM 204); no specific locality (USNM 44702, 16000-01). *Torrance Co.:* Torrance (USNM 65832).

TEXAS. *El Paso Co.:* Guadalupe Mts. (Bailey, 1905); *Jeff Davis Co.:* No specific locality (Marr, 1944); Pecos River & Rio Grande (USNM 205).

Phrynosoma douglassii ornatum Girard

Phrynosoma ornatum Girard, Report of the Exploring Expedition for the years, 1838, 1839, 1840, 1841, 1842 under the command of Charles Wilkes, USN, vol. 20, 1858, Herpetology Atlas, pl. 21, figs. 1-5.

Tapaya douglassii Girard, Report of the Exploring Expedition for the years 1838, 1839, 1840, 1841, 1842 under the command of Charles Wilkes, USN, vol. 20, Herpetology, (in text), 1858, pp. 388-410 (*part.*); Baird, Report of the Exploration and Surveys to ascertain the most Practicable and Economic Rail Road Route to the Pacific Ocean, vol. 10, 1859, p. 18.

Phrynosoma douglassii Yarrow, Report of the Geography and Geology Surveys West of the 100th Merridian under Lt. Wheeler, vol. 5, 1875, pp. 580-581, 591-593 (*part.*); Van Denburgh & Slevin, Proc. California Acad. Sci., vol. 5, 1915, pp. 100, 105.

Phrynosoma douglassii ornatissimum Coues & Yarrow, Bull. U. S. Geol. & Geol. Surv., vol. 4, 1878, pp. 286-287, (*part.*); V. M. Tanner, Copeia, 1928, pp. 23-28; Ruthven, Occas. Papers Mus. Zool. Univ. Michigan, no. 243, 1932, p. 3. Stuart, Occas. Papers Mus. Zool. Univ. Michigan, no. 244, 1932, pp. 1-33, pls. 1-4; Knowlton & Janes, Copeia, 1934, p. 12, Knowlton & Thomas, Copeia, 1936, p. 65; Hardy, Proc. Utah Acad. Sci., Arts & Letters, vol. 15, 1938, p. 100; W. W. Tanner Proc. Utah Acad. Sci., Arts & Letters, vol. 16, 1939, p. 105; Linsdale, Proc. Amer. Acad. Arts & Sci., vol. 73, 1940, p. 232, map; W. W. Tanner, Great Basin Nat., vol. 1, 1940, p. 141.

Phrynosoma douglassii hernandesi Cope, Rept. U. S. Nat. Mus. for 1898 (1900) pp. 413-415 (*part.*); Richardson, Proc. U. S. Nat. Mus., vol. 48, 1915, pp. 405, 423-424.

Phrynosoma douglassii douglassii Pack, Copeia, 1918, pp. 91-92.

Phrynosoma douglassii ornatum Stejneger, Copeia, 1919, pp. 3-4; Stejneger & Barbour, Check List of North American Amphibians and Reptiles, 2 ed., 1923, p. 62; V. M. Tanner, Copeia, 1928, p. 23; Ruthven, Occas. Papers. Mus. Zool. Univ. Michigan, no. 243, 1932, p. 3; Stejneger & Barbour, Check List of North American Amphibians and Reptiles, 3 ed., 1933, p. 68; W. W. Tanner, Proc. Utah Acad. Sci., Arts & Letters, vol. 16, 1939, p. 105; Stejneger & Barbour, Check List of North American Amphibians and Reptiles, 4 ed., 1939, p. 74; W. W. Tanner, Great Basin Nat., vol. 1, 1940, p. 141.

Phrynosoma orbiculare ornatum Klauber, Bull. Zool. Soc. San Diego, no. 14, 1939, p. 93; Stejneger & Barbour, Bull. Mus. Comp. Zool. Harvard Coll., vol. 93, 1943, p. 95.

Taxonomic history: The name *Phrynosoma ornatum* first appears as a caption on a plate in the atlas accompanying Girard's work in the United States Exploring Expedition . . ., 1858. However, it was placed in the synonymy of *Tapaya douglassii* in the text of the same work. The explanation by Girard is that the plates were processed previous to the printing of the text and *ornatum* had been thought to be distinct and was so figured for the atlas. But it seems that he had changed his mind too late to correct the caption in the

atlas, but soon enough to correct the text. The name thus stands based on the figure in the atlas. Stejneger (1919) was first to clarify the use of the name.

Diagnosis: Temporal area as wide as, or wider than, head width at angle of jaws; length of each temporal and occipital spine equal to or greater than its basal diameter; light-colored borders generally confined to posterior portion of dorsal spots; size medium to small.

Description: Size medium to small; head wider than long; frontal area flat, covered with medium to large, irregular, rugose scales; snout moderately pointed; rostrofrontal angle obtuse; nostrils medium sized, slightly below canthal line, opening laterally; supralabials small, inconspicuous; infralabials small, increasing slightly in size posteriorly, continuous with postlabials; three enlarged postlabials extending from angle of jaw to postrictal scale; latter small, conical; chinshields small, increasing in size posteriorly, separated from infralabials by three small sublabials; gular scales subequal throughout; tympanum exposed, opening bordered anteriorly with several slightly enlarged scales; two lateral neck patches of enlarged soft spines; occipital area with several slightly enlarged tubercles; occipital spines short projecting slightly upward; basal diameter of each equaling its length; intraoccipital distance equal to approximately four times basal diameter of one spine; temporal area moderately expanded; three small temporal spines, length of each equal to, or greater than, its basal diameter; lateral profile of temporal horns forming straight line, projecting to approximate region of angle of jaw; dorsal scales small imbricate, smooth, interspersed with varying sizes of enlarged, keeled soft spines; larger scales forming from six to eight indefinite longitudinal rows between neck and rump, four rows on rump and base of tail, diminishing to two rows on tail; one row of enlarged soft spines in the lateral abdominal fringe; dorsal surface of legs with numerous enlarged keeled soft spines; arms with a few enlarged keeled scales anteriorly; ventral scales small, smooth, imbricate; femoral pores 12-14, rows separated mesially by three preanal scales.

Dorsal ground color greenish gray; nuchal blotches dark brown, fading into ground color ventrally and posteriorly; three pair dark brown or black dorsal spots between neck and rump; first spot near mid-point of above distance; dorsal spots bordered posteriorly in white; one pair dark spots on base of tail; several dark transverse bands on remainder of tail; head olive; horns light gray.

Variations: The proportions of the head and in particular the temporal area varies somewhat throughout the range of this subspecies. The temporal area is expanded and generally flattened above, similar to that of *hernandesi.* However, in some specimens this area may be slightly convex. The usual row of three small temporal spines may be augmented by a fourth spine.

The ground color may vary from a greenish gray to a light tan setting off dorsally the dark brown or black dorsal spots. The latter are usually bordered posteriorly in white or light gray, rarely being bordered mesially.

Discussion: This form is most closely related to *hernandesi,* differing in its smaller size, generally lighter color and the more moderate development of the temporal areas and spines. A major controversy has existed regarding the validity of this form, which I believe has been caused by a misunderstanding of the true relationships involved and a lack of an adequate picture of the species as a whole. The form is intermediate between *hernandesi* and *douglassii,* but has enough distinctive characters to warrant subspecific recognition.

General distribution: The range of this form coincides closely with the area covered by the old Pleistocene Lake Bonneville, extending from Iron County, Utah on the south, to southern Idaho on the north, and westward into the northeastern part of Nevada.

Locality records: NEVADA. *Elko Co.:* Carlin (USNM 45241); Deeth (Linsdale, 1940); 22 mi. N (Linsdale, 1940); Halleck (USNM 44819-21), 3 mi. S (USNM 71187).

UTAH. *Box Elder Co.:* Rosette, 8 mi. S (Knowlton & Janes, 1934); no specific locality (USNM 4927, 5321). *Cache Co.:* Hyrum (BYU 2809, 2118). *Millard Co.:* Filmore (Ruthven, 1932); Great Basin Experimental Station (BYU 433). *Salt Lake Co.:* Emigration Canyon (UU 1351, 2265); Ft. Douglas (UU 1968-70, 2306, 374), (BYU 2095, 2097, 2778); Little Black Mt. (UU 57, 56); Mill Creek Canyon (UU 2115); Salt Lake City (UU 8586, 3690), (USNM 60925, 318234, 60940-73, 42113, 4979); no specific locality (UU 125-129). *Tooele Co.:* Tooele Canyon (UU 205-06); Tooele Valley (UU 368). *Utah Co.:* Alpine (UU 369); Cedar Fort (USNM 44762-63); Lehi, west of (BYU 2786); Mt. Timpanogos (BYU 8051-52); Provo Bench (UU 371); Provo (BYU 3062, 3356); west side of Utah Lake (UU 2263).

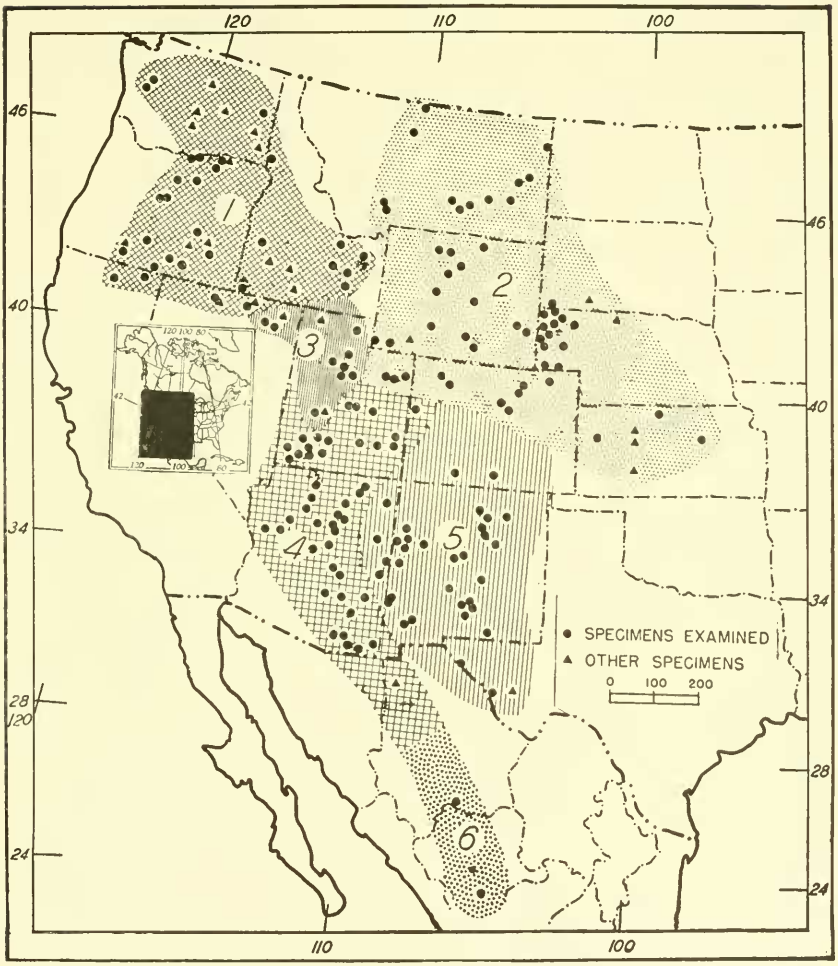


FIG. 10. Map showing the geographic distribution of the species *Phrynosoma douglassii*.

1. *Phrynosoma d. douglassii*
2. *Phrynosoma d. brevirostre*
3. *Phrynosoma d. ornatum*
4. *Phrynosoma d. hernandesi*
5. *Phrynosoma d. ornatissimum*
6. *Phrynosoma d. brachycercum*

Phrynosoma orbiculare cortezii Aug. Duméril and Bocourt

Phrynosoma orbiculare Wiegmann, Herpetologia Mexicana, 1834, p. 53, pl. 8, fig. 1; Blatchley, Proc. U. S. Nat. Mus., vol. 16, 1893, p. 41.

Tapaya cortezii Aug. Duméril and Bocourt, Mission Scientifique au Mexique et dans l'Amérique Centrale, Études sur les Reptiles, livr. 1, 1870, pl. 9, figs. 2, 2a-2g.

Tapaya orbicularis Var. A. Bocourt, Mission Scientifique au Mexique et dans l'Amérique Centrale, Études dans les Reptiles, livr. 4, 1874, pp. 223-224, pl. 11, figs. 2, 2a-2g.

Phrynosoma orbiculare cortezii Günther, Biologia Centrali-Americana, Reptilia and Batrachia, 1890, p. 78; Smith, Trans. Kansas Acad. Sci., vol. 37, 1934, pp. 291-292, pl. 11, fig. 1, pl. 12, fig. 6; Smith, Field Mus., Nat. Hist. Zool. Ser., vol. 24, 1939, p. 23; Smith & Taylor, Univ. Kansas Sci. Bull., vol. 33, pt. 2, 1950, p. 349; Bull. U. S. Nat. Mus., no. 199, 1950, p. 98.

Diagnosis: This form can be separated from the others of the species by greater head width to head length ratio; temporal horns projecting farther posteriorly than occipitals; rarely more than a single series of preanal pores.

Description: Head considerably broader than long; frontal area flat; nares on canthal line, separated by distance equal to two times diameter of naris; superciliary spine approximately one half length of occipitals, concave on outward side, terminating the moderately developed superciliary ridges; a series of five enlarged tubercles anterior to occipital spines; latter approximately as broad as long, interoccipital space equaling about one half spine diameter; three temporal spines present, innermost longer than broad and projecting slightly beyond occipitals; space between occipital spine and innermost temporal spine approximately equal to basal diameter of innermost temporal; temporal shelf covered with moderately enlarged scales; supralabials 7-9, small, enlarging posteriorly; infralabials 8-9, last four becoming pointed; postlabials three, the row curving downward coming in contact with postrictal at anterioventral corner of exposed tympanum; sublabials moderately large, separated from infralabials by three small scales; gular scales subequal throughout; lateral neck fold having five enlarged spines, second smaller fold more ventral, bearing four spines; a single mid-dorsal nuchal spine; vertebral row of minute scales bordered by series of slightly enlarged keeled scales; three series of large soft spines forming longitudinal rows down either side of back, two inner rows of each side converging into one at base of tail and continuing on tail as single row; single series of lateral abdominal spines; corresponding series on tail; dorsal femoral area with three indistinct spine rows; fringes on anterior upper arm and posterior surface of lower area; ventral scales smooth throughout; femoral pores 15-16, separated mesially by four preanal scales.

Dorsum of head uniformly blackish brown; ground color of dorsum of body ivory, darkening laterally and posteriorly into dark gray nuchal blotches black, separated mesially by normal ground color; four pairs of indistinct dark patches each edged posteriorly in light ground color, paralleling vertebral column; several indistinct spots on tail; ventral ground color white, with narrow irregu-

lar black lines forming reticular network; tail with alternating spots anteriorly, transverse bands toward end.

Variation: A series of some 30 specimens from Las Vigas, Veracruz, and vicinity, show the following major variations:

The femoral pores in this subspecies usually are arranged in a single row. However, in five of the specimens extra pores were present forming an incomplete second row on the preanal area, posterior to the main row. The characteristic narrow reticulate ventral pattern appears markedly wider and darker in several specimens, being almost totally black in one. In most adults the occipital spines project farther posteriorly than the temporal spines; otherwise, the two sets of spines of adults were of equal length.

Locality records: Mexico. *Puebla*: Atzitzintla (Smith, 1939); San Diego, south of Tehuacán (Smith & Taylor, 1950); San Marcos, 15 mi. E (EHT-HMS 1845). *Veracruz*: Jalapa (USNM 4596, 3 spec.); La Joya, 1 mi. W (EHT-HMS 28861-62); Limón, 3 km W (KU 25882); Las Vigas (KU 25852, 25854-56, 25858-61, 25863-64, 25866-73, 25875-81, 25883-86); 4 km E (KU 25874); 5 km E (Smith & Laufe, 1945); Perote (Smith & Taylor, 1950b); San Andrés, South of (Blatchley, 1893); Zacualpillo, 6 km WSW (KU 25853, 25857, 25862, 25865).

Phrynosoma orbiculare dugesii Aug. Duméril & Bocourt

Tapaya Dugesii Aug. Duméril and Bocourt, Mission Scientifique au Mexique et dans l'Amérique Centrale, Études sur les Reptiles, livr. 1, 1870, pl. 11, figs. 3a-3g. (They state that *Tapaya* is a subgenus under *Phrynosoma*.)

Tapaya orbicularis Var. B. Bocourt, Mission Scientifique au Mexique et dans l'Amérique Centrale, Études sur les Reptiles, livr. 4, 1875, pp. 224-225, pl. 11, fig. 3, 3a-3f.

Phrynosoma orbiculare (var.) *dugesii* Boulenger, Catalogue of the Lizards in the British Museum of Natural History, vol. 2, 1885, p. 243; Günther, Biologia Centrali-Americana, Reptilia and Batrachia, 1890, p. 78.

Taxonomic history: August Duméril and Bocourt (1870) named this form from two specimens collected at Colima, Mexico, by Alfredo Dugès. It was given full specific rank. Bocourt (1874) reduced it to variety β under *Tapaya orbicularis*. Boulenger (1885) correctly referred it to *Phrynosoma orbiculare* (var.) *dugesii*.

Diagnosis: This rare form can be recognized by the approximately equal extension posteriorly of occipital and temporal horns; by head being nearly as long as wide; and by fewer (14-14) femoral pores all in single row on each side.

Only the type specimens (not seen by me) are known. Bocourt's (1874) description follows:

"Tête relativement déprimée; sa longueur, comprise entre le bout du museau et l'extrémité d'une des épine de l'occiput, égale sa plus grande largeur; écailles sous-labiales postérieures pointues, plus grandes que les scutelles inframaxillaries; ces denières, de forme rectangulaire, sont disposées en une rangée sous chacune des branches de la mâchoire inférieur; une squame conique et pyramidale à la commissure des lèvres; narines percées à l'extrémité antérieure de la ligne sourcilière; plaque occipitale ovalaire, plus grande que les tubercles nombreux qu'elle précède; treize à quinze pores sur la partie interne des cuisses; queue entrant pour les deux cinquièmes dans la longueur totale de l'animal, charactérisée, chez les mâles, par une basé volumineuse et par deux écailles postanales distinctement plus grandes que les autres; une seule dentelure sur la périphérie de l'abdomen, formée de trente squames trièdres et subpyramidales; une autre squame de même forme au-dessus de chacun des bras; longueur du tibia égalant le distance comprise entre le bout du museau et la naissance de épines occipitales; écailles du ventre, de la gorge et du dessous de la queue lisses.

"*Coloration.* Teinte générale roussâtre; chacun des côtés du cou marqué d'une grande tache noire; à droite et à gauche de la ligne vertébrale, une double série de trois autres taches brunes, circonscrites en arrière par un étroit filet jaune; membres, bassin et queue traversés par des bandes de même couleur; tempes et épines céphaliques d'un rouge brique. En dessous, sur un fond jaunâtre, se détachent des marbrures ou taches noires confluentes, répandues sur le ventre et sur la queue; une ligne de cette dernière teinte parcourt la région médio-abdominale."

General distribution: Known only from Colima.

Locality record: MEXICO. *Colima:* No specific locality (Aug. Duméril & Bocourt, 1870).

Phrynosoma orbiculare orbiculare (Linnaeus)

Tapayaxin Lacertus orbicularis Hernandez, Plantos Animales de las Nueva España . . ., libr. 9, c. 16, 1651, p. 327, fig. (unnumbered).
Lacerta orbicularis spinosus Seba, Locupletissimi Rerum Naturalium Thesauri accurati Descriptio, et Iconibus Artificiosissimis Expressio, Per Universan Physices Historiam, vol. 1, 1734, p. 141, pl. 83, figs. 1-2.
Lacerta orbicularis Linnaeus, Systema Naturae, ed. 12, 1766, p. 365 (*part.*).
Cordylus orbicularis Laurenti, Specimen Medicum, Exhibens Synopsin Reptilium . . ., 1768, p. 55.
Tapaja orbicularis *Oken, Lehrbuch der Naturgeschichte dritter Theil. Zoologie zweite Abteilung. Fleischthiere. Jena, 16, 1816, p. 294.
Tapayis orbicularis Gray, Ann. Philos., NS vol. 26, 1825, p. 197.

* Oken used *Tapaja* in a subgeneric sense, under the genus *Agama*. The trivial names of *Tapaja* are not used with it, but with *Agama*.

Tapaya orbicularis Fitzinger, Neu Classification der Reptilien, 1826, p. 17; Girard, Exploring Expedition during the years 1838, 1839, 1840, 1841, 1842 under the command of Charles Wilkes, USN., vol. 20, Herpetology, 1858, p. 406; Bocourt, Mission Scientifique au Mexique et dans l'Amérique Centrale, Études sur les Reptiles, livr., 4, 1874, pp. 221-222, pl. 11, figs. 1-1a-g.

Phrynosoma orbiculare Wiegmann, Isis von Oken, vol. 21, 1828, pp. 365-369; Gravenhorst, Act. Acd. Caes. Leopold. Carol. Nat. Cur., vol. 16, pt. 2, 1833, p. 912, pl. 62; Wiegmann, Herpetologia Mexicana, 1834, p. 53; Duméril & Bibron, Erpétologie Générale au Histoire Naturalle, des Reptiles, vol. 5, 1837, pp. 321-323; Gray, Catalogue of the Species of Lizards in the Collection of the British Museum of Natural History, 1845, p. 228; Duméril & Duméril, Catalogue Methodique de la Collection des Reptiles du Muséum d'Histoire Naturelle de Paris, 1851, pp. 78-80; Girard, in Stansbury's Exploration of the Valley of the Great Salt Lake of Utah, 1852, p. 359; Sumichrast, Arch. Sci., Phys. Math., vol. 19, 1864, p. 60; Garman, Biol. Essex Inst. vol. 19, 1887, p. 131; Cope, Rept. U. S. Nat. Mus., 1898 (1900), pp. 407, 417-419 (*part.*); Gadow, Proc. Zool. Soc. London, 1905, p. 213; Ditmars, Reptiles of the World, 1910, pp. 150-151, 153; Ruthling, Copeia, no. 72, 1919, pp. 67-68; Mertens & Wolterstorff, Abhandl. Ber. Mus. Natur. Heimatk. Natur. ver. Magdeburg, vol. 6, pt. 2; 1930, p. 158; Ochoterena, Ann. Inst. Biol., vol. 3, 1932, pp. 81-94; Dunn, Proc. Acad. Nat. Sci. Philadelphia, vol. 88, 1936, p. 475.

Agama orbiculare Bell, Trans. Linn. Soc. London, vol. 16, 1829, pp. 105-107.

Phrynosoma Wiegmanni Gray, Zoology Beechy's Voyage, 1839, p. 96.

Tapaya orbicularis longicaudatus Dugès, La Naturalieza, ser. 2, vol. 1, 1888, p. 177.

Phrynosoma orbiculare orbiculare Günther, Biologia Centrali-Americana, 1890, p. 78; Smith, Trans. Kansas Acad. Sci. vol. 37, 1934, pp. 287-297, pl. 11, fig. 2 and pl. 12, fig. 5; Smith, Ann. Carnegie Mus., vol. 27, 1939, p. 315; Taylor & Knobloch, Proc. Biol. Soc. Washington, vol. 53, 1940, pp. 125-126; Smith & Necker, Anales de la Escuela Nacional de Ciéncias Biologicas, vol. 3, 1943, pp. 216-218, pl. 2, fig. 1; Smith & Laufe, Trans. Kansas Acad. Sci., vol. 48, 1945, pp. 336-337; Smith & Taylor, Univ. Kansas Sci. Bull. vol. 33, pt. 2, 1950, pp. 329, 375; Bull. U. S. Nat. Mus., no. 199, 1950, pp. 97-98.

Taxonomic history: The unnumbered figures of Hernandez (1615) as copied by Seba (1734) formed the basis of the Linnean designation *Lacerta orbicularis.* Laurenti (1768) removed it from *Lacerta* and placed it in his genus *Cordylus.* The two species *hispidus* and *orbicularis,* which he placed in this genus were both based upon the figures of Seba (*op. cit.*). The former was based on plate 109, fig. 6, and the latter upon plate 83, figs. 1, 2, which in turn were reproduced from Hernandez. Oken (1816) relegated *orbiculare* to his subgenus *Tapaja* under the genus *Agama.* Gray (1825) placed *orbiculare* in his subgenus *Tapayia* and was followed by Fitzinger (1826) who assigned it to *Tapaya.* All three names antedate Wiegmann's (1828) *Phrynosoma orbiculare.* Aug. Duméril and Bocourt (1870) Bocourt (1874) and Girard (1858 referred *orbiculare* to *Tapaya.* Günther (1890) correctly used the name *Phrynosoma orbiculare* variety *orbiculare* and this has, in general, been followed since.

Diagnosis: This Mexican Plateau form can be recognized by: head only slightly wider than long; occipital spines projecting

backwards beyond temporal spines; additional preanal pores usually forming a double series mesially.

Description: Head slightly broader than long; nares on canthal line, separated by distance equal to approximately twice diameter of one naris; temporal spines nearly equal in size to, and projecting back to a point slightly less than occipital spines; distance between base of occipital spines less than basal diameter of one spine; short inconspicuous interoccipital spine present; three enlarged temporal spines, inner one largest; two tubercles on occipital shelf in front of occipital spines; supralabials 9-10, rounded on ventral surface; infralabials slightly enlarged 8-8, three pointed postlabials forming modified fringe at the angle of the mouth; long, broadly based postrictal at anterioventral corner of auricle; chinshields moderate in size, extending from small mental to below enlarged postlabials; three small sublabials separating chinchields from infralabials; gulars subequal; gular fold large; abdominal scales smooth throughout, 38-40 across widest part of abdomen; femoral pores 14-15; rows separated mesially by five preanal scales; extra pores forming double row on preanal area; several indistinct rows of enlarged scales on back converging into two paired rows on rump; two rows of spines on tail; single row of lateral abdominal spines extending from shoulder above arm to groin.

Dorsal ground color yellowish tan with brown and grayish-brown blotches; nuchal blotches dark, extending to above shoulders; three pair smaller less conspicuous dark spots over remainder of back; tail traversed by several dark bands; ventral surface of body with dark, heavy, reticular pattern that nearly obliterates light ground color; tail with several dark bands corresponding to those on dorsal surface.

Variation: The head proportions in this form vary from a condition in which the head is equal in length and width to a condition in which the head is 22 percent wider than long. There are often additional femoral or preanal pores which make a double row usually in the preanal area. The ventral pattern usually consists of a network of broad, dark bands, however, a light-spotted condition may occur. The occipital spines project posteriorly beyond the temporal spines in nearly all adult specimens.

Discussion: The conspecificity of the species *P. orbiculare* and *P. douglassii* proposed by some authors has been found to be erroneous. The two are undoubtedly distinct species.

General distribution: The distribution of this form is on the plateau of Mexico from Chihuahua and Nuevo León, south to Morelos and Puebla.

Locality records: MEXICO. *Chihuahua:* Chihuahua City, S of (Smith & Taylor, 1950b); Minaca, 21 mi. S (Dunn, 1936); Mojárachic (EHT-HMS 23046-47, 30125); Samachique (Smith & Taylor, 1950). *Distrito Federal:* Navitas, between Chalco and (Smith & Taylor, 1950); Tacuila, 3 mi. W (AMNH 15423-24); Tlalpam (Smith & Taylor, 1950); Tlalenpantla (Smith & Taylor, 1950). *Durango:* Ciudad (Günther, 1890); Coyotes (Smith, 1939); El

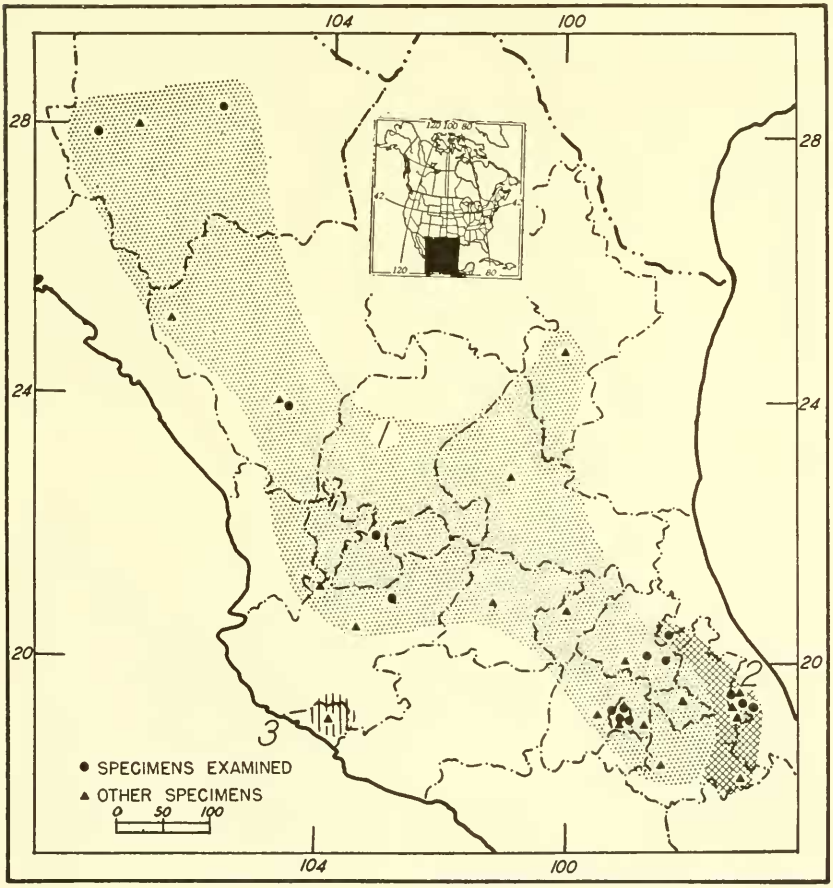


FIG. 11. Map showing the geographic distribution of the species *Phrynosoma orbiculare*.

1. *Phrynosoma o. orbiculare* 2. *Phrynosoma o. cortezii*
3. *Phrynosoma o. dugesii*

Salto (USNM 47469), 10 mi. E (AMNH 68359). *Guanajuato:* Guanajuato (city) (Smith & Taylor, 1950). *Hidalgo:* Actopan (Smith & Taylor, 1950); El Chico Parque Nacional (EHT-HMS 19235); Mexico (city), 65 km. N (EHT-HMS 19240, 23985); Pachuca, near (EHT-HMS 22245); Tulancingo, 2-3 mi. W (EHT-HMS 19237-38). *Jalisco:* Río Santiago, north of (Günther, 1890); Guadalajara (Smith & Taylor, 1950); Balaños (Smith & Taylor, 1950b); Yahualica, 2 mi. W (KU 28067). *Michoacán:* Jorullo, above Zumpango (Smith & Taylor, 1950b). *Morelos:* Tres Marías, near km. 57 (Smith, 1934); *Nuevo León:* Hacienda Pablillo, above Galeana (Dunn, 1936). *Puebla:* Matamoros (Smith & Taylor, 1950); Rió Otlati (Smith & Laufe, 1945); San Martín (USNM 47706), 15 km. NW (Smith & Laufe, 1945); Tezuitlán (Smith & Taylor, 1950); Tlalnepantla (Smith & Taylor, 1950). *Querétaro:* No specific locality (Smith & Taylor, 1950). *San Luis Potosí:* San Pedro (Dunn, 1936); Sapotillo (AMNH 69702). *Mexico:* Dos Rios (EHT-HMS 31627); Lerma (Smith & Taylor, 1950); Mexico City (USNM 12717), 17 km. ESE (Smith & Laufe, 1945), 23 km. SE (Smith & Laufe, 1945); San Andres (Smith & Taylor, 1950); San Barlolito, 1 mi. W (AMNH 15426-28); El Tajo de Tequisquiac (MVZ 8844-49); Tiza, 45 km. N Mexico City (EHT-HMS 10448). *Tlaxcala:* Tlaxcala City, 13 km. NE (Smith & Laufe, 1945). *Zacatecas:* Plateado (USNM 47874, 47876-78); Sierra Madre Mts. (Taylor & Knobloch, 1940).

Phrynosoma ditmarsi Stejneger

Phrynosoma ditmarsi Stejneger, Proc. U. S. Nat. Mus., vol. 29, 1906, pp. 565-567; Ditmars, The Reptile Book, 1907, p. 154, pl. 46, figs. 3, 7, 48; Reptiles of the World, 1910, p. 150; Lampe, Jarhb. Nassau Ver. Naturk., vol. 64, 1911, p. 163; Bryant, Univ. California Publ. Zool., vol. 9, 1911, p. 5; Stejneger & Barbour, Check List of the North American Amphibians and Reptiles, 1917, p. 58; Van Denburgh, Occas. Papers California Acad. Sci., no. 10, 1922, pp. 386-387; Stejneger & Barbour, Check List of the North American Amphibians and Reptiles, 2 ed., 1923, p. 61; Cuesta Terron, Anal. Inst. Biol. vol. 3, 1932, pp. 99-100, fig. 2; Stejneger & Barbour, Check List of North American Amphibians and Reptiles, 3 ed., 1933, p. 67; Smith, Trans. Kansas Acad. Sci., vol. 37, 1934, p. 287; Stejneger & Barbour, Check List of North American Amphibians and Reptiles, ed. 4, 1939, p. 73; Burt, Trans. Kansas Acad. Sci., vol. 38, 1936, pp. 261-300, 304; Stejneger & Barbour, Bull. Mus. Comp. Zool. Harvard Coll., vol. 93, 1943, p. 93; Bogert & Oliver, Bull. Amer. Mus. Nat. Hist., vol. 83, 1945, pp. 315, 319, 334; Smith & Laufe, Trans. Kansas Acad. Sci., vol. 48, 1945, p. 337; Smith, Handbook of Lizards, 1946, pp. 289, 297-299.

Taxonomic history: The species *Phrynosoma ditmarsi* was described and named by Stejneger (1906) from two specimens given to the United States National Museum by Raymond Ditmars. The

specimens were collected by Mr. Eustace in northern Sonora, Mexico and sent to the New York Zoological Society where they were kept alive for some time. The validity of this species has never been questioned.

Diagnosis: This rare species can be distinguished by the following characters: nostrils on canthal line; one series of serrate scales bordering abdomen; tympanum exposed; single enlarged row of scales on gular area; ventral scales keeled throughout; lower jaw greatly expanded; five to seven sublabial scales; characteristic "horns" absent.

Stejneger's original description (1906:565-567) based on the holotype, an adult male, is as follows:

"Head much broader than long; nostrils in the line of canthus rostralis; tympanum entirely posterior, vertical to the axis of the body, concealed in the anterior neck fold, naked; no horns, the scales which in the other species form more or less projecting spines being only low bosses or protuberances; the postocular boss, a broad triangular pyramid, its three edges being continuations of the superciliary, the supraocular, and the orbito-temporal ridges; an abrupt raised orbito-temporal ridge from tip of postorbital boss to outer edge of the supratemporal expansion at the base of the scale corresponding to the outer temporal horn in other species, two scales corresponding to temporal horns slightly enlarged, depressed, the posterior, or inner, slightly pointed; below the scale row forming the upper posterior edge of the supratemporal expansion on each side a small conical spine; supratemporal expansion very wide, nearly straight behind, with a very deep and narrow occipital notch; no temporal ridge; on the edge of the fold in front of the ear a vertical series of 4 small spines; rostral very low; supralabials very small, scarcely differentiated from the scale row above, about 15 in number; about 15 small lower labials, the posterior ones gradually increasing in size, though not larger than the scutes forming the orbito-temporal ridge, and with a raised keel; a small spine behind the last lower labial, separated from it by a single scale; along the edge of the lower mandible a series of enlarged, strongly keeled submandibulars, increasing in size backward, the keels of the posterior ones slightly produced and pointed behind; mandible exceedingly deep, the distance between angle of mouth and base of submandibular shields being greater than the diameter of the orbit; large flat space between the lower labials and the submandibulars covered with polygonal scales of varying sizes, similar to those covering the upper surface of the head, about 5 in

a row; all head scales keeled and wrinkled; gular scales small, keeled; a series of spines on each side of the posterior half of the throat near the submandibulars and parallel with them; gular fold with transverse series of spines and a few isolated clusters of spines; a very heavy angular fold on each side of the neck, both the vertical and horizontal portion armored with clusters of large spines; back and upper surfaces of hind legs and tail with scattered larger, bluntly keeled scales, the largest with their base surrounded by a "rosette" of smaller scales, which are larger than those forming the general dorsal lepidosis; a single series of marginal scales, which are enlarged and bluntly pyramidal, set between 2 basal rows of slightly enlarged scales; scales of the fore legs and lower surfaces strongly keeled, the former pointed behind; a series of 13 (14) femoral pores on each side, separated on the middle of the belly by 4 scales, the pores piercing the scales near the posterior margin; base of tail strongly swollen, with 2 enlarged postanals; tail once and a third longer than head.

"Color (in life) 'reddish—the color of dry building sand, with very obscure markings,' according to Mr. Ditmars; in alcohol, pale yellowish gray, with two faint, narrow, brownish bands across the lower back; underside whitish, with very obscure dusky spots."

Discussion: Three specimens of this species are now known. Two are in the collection of the U. S. National Museum and the third in the American Museum of Natural History. The latter specimen carries only the general locality data of northern Sonora and thus adds nothing to our knowledge of the geographic distribution of the species. The absence of the spines, the enormous development of the lower jaw, the extreme notched condition of the occipital area and other cranial features would seem to indicate that the nearest relative of *P. ditmarsi* is *douglassii.* This affinity is however, by no means close for numerous characters will adequately separate the two.

Distribution: This species has been reported only from the general locality of northern Sonora.

Locality records: MEXICO. *Sonora:* Near boundary of Arizona (USNM 36022, 36012); northern Sonora (AMNH 557).

Phrynosoma boucardii Aug. Duméril and Bocourt

Tapaya boucardii Aug. Duméril and Bocourt, Mission Scientifique au Mexique et dans l'Amérique Centrale; Études sur les Reptiles, livr. 1, 1870, pl. 11, figs. 4a-f; and Bocourt *idem,* livr. 4, 1874, pp. 225-226, pl. 11, fig. 4, 4a-f.

Phrynosoma boucardii Boulenger, Catalogue of the Lizards in the British Museum of Natural History, 2 ed., vol. 2, 1885, p. 234; Herrick, Terry & Herrick, Bull. Sci. Lab. Denison Univ., vol. 11, 1889, p. 133; Cope, Rept. U. S. Nat.

Mus. 1898 (1900), p. 407; Bryant, Univ. California Publ. Zool., vol. 9, 1911, p. 5; Smith & Laufe, Trans. Kansas Acad. Sci., vol. 48, 1945, p. 338; Smith, Journ. Washington Acad. Sci., vol. 39, 1949, p. 38; Smith & Taylor, Univ. Kansas Sci. Bull., vol. 33, pt. 2, 1950, p. 333; Bull. U. S. Nat. Mus., no. 199, 1950, pp. 98, 99.

Taxonomic history: Aug. Duméril and Bocourt (1870) described and named this species from specimens in the Museum d'Histoire Naturelle de Paris, collected by M. Boucard on the plateau of Mexico. They placed the species in the subgenus *Tapaya.* Boulenger (1885) discarded the subgenus *Tapaya,* placing it in *Phrynosoma* where it has since remained.

Diagnosis: Nostrils on canthal line; one row of lateral abdominal scales; gular scales subequal and faintly keeled; superciliary spines large and prominent.

Description: Head broader than long, distinctly triangular; frontal area inclined steeply forward; nostrils on canthal line, of moderate size; space separating nostrils approximately two and one-half to three times diameter of nostril; superciliary ridges slightly raised, ending posteriorly in a large semicircular spine oriented with flat or concave side laterad; occipital spines moderately long and divergent; interoccipital space greater than basal diameter of one occipital spine; temporal shelf moderately expanded, edged laterally with three temporal spines, posterior one being only slightly smaller than occipital spine; tympanum exposed; infralabials increasing in size posteriorly and continuous with postlabials; latter curving slightly downward to meet chinshields immediately in front of long conical postrictal spine; three small sublabials separating chinshields from infralabials; gular scales subequal, imbricate, pointed posteriorly, and lightly keeled; gular fold covered posteriorly by minute scales; large prescapular fold bearing series of large pointed spines projecting from neck posterior to tympanum; second smaller fold appearing just below, and more or less connected to above; single lateral abdominal scale row borne anteriorly on fold of skin, originating in front of arm attachment, extending to near mid-point of body where fold disappears; dorsal squamation consisting of vertebral line of small imbricate scales bordered on either side by row of slightly larger keeled scales; six indistinct, longitudinal rows of enlarged spines; two rows continuing on tail; neck bearing pair of large dorsolateral spines; ventral scales smooth throughout; eight or nine femoral pores on each side, rows being separated mesially by five preanal scales.

Dorsal ground color light tan to gray; pair of dark brown to black

neck blotches extending from posterior limits of head laterally over shoulder area to neck folds, followed by three pairs of dark brown spots each surrounding large dorsal spine; dark area on base of tail, followed by approximately six transverse bands on tail; head olive with three faint vertical bars below eye; ventral color pale yellow with numerous black spots, some of which unite to form reticular pattern.

Distribution: This species has been reported only from the Mexican states of Guanajuato and Hidalgo. Probably it occurs also in Querétaro, which lies between the above two states, and possibly also in the northeastern part of Jalisco. The type locality has been restricted to Zimapán, Hidalgo, Mexico, by Smith & Taylor (1950a).

Locality records: MEXICO. *Guanajuato:* León (Smith & Taylor, 1950b). *Hidalgo:* Zimapán (USNM 11370).

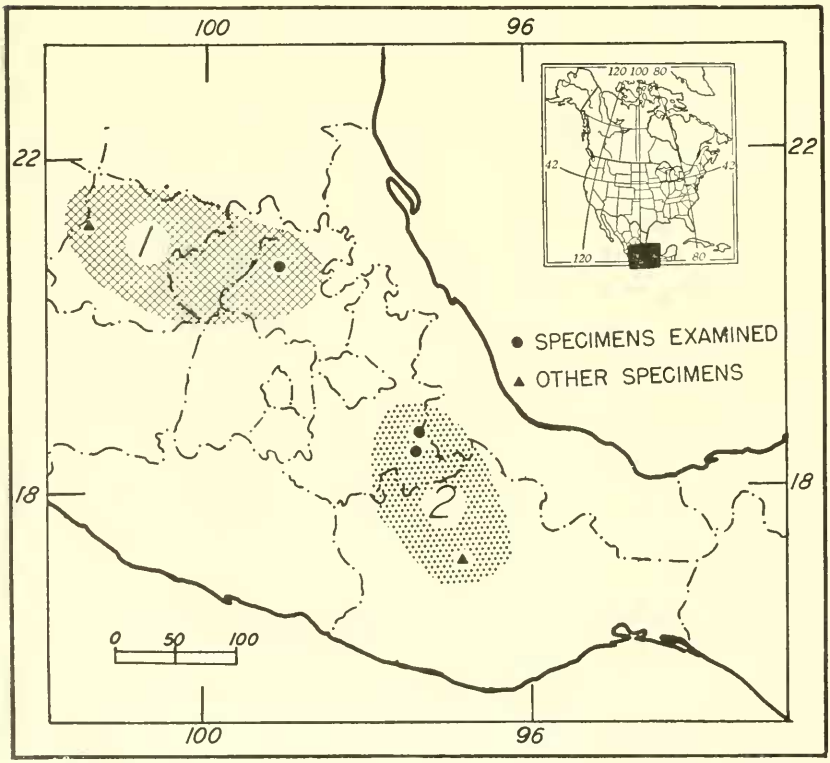


FIG. 12. Map showing the geographic distribution of the species: 1. *Phrynosoma boucardii* and 2. *Phrynosoma braconnieri*.

TABLES

TABLE 1. The number of teeth borne by the premaxillary bone

SPECIES	Number of specimens	Number of teeth
P. cornutum	20 spec.	19 with 4; 1 with 5
P. solare	3 spec.	3 with 6
P. douglassii	4 spec.	4 with 6
P. modestum	1 spec.	1 with 6
P. coronatum	2 spec.	2 with 8
P. orbiculare	1 spec.	1 with 4
P. m'callii	1 spec.	1 with 2

TABLE 2. Actual measurements

		Total length	Snout-vent	Axilla-groin	Arm length	Leg length	Head length	Head width	Eye-snout	Eye-ear	Ear-snout
P. p. goodei											
♂ 8567a	USNM	114	.....	73	38	51	14	14	6	5	14
♂ 8567b	USNM	.....	.....	.....	35	47	.....	snout	crushed		.....
♂ 10166	MVZ	114	.....	70	33	47	14	14	7	4	12
♂ 69653	AMNH	100	.....	63	31	42	14	13	7	4	11
♂ 69654	AMNH	104	.....	64	33	46	14	13	6	5	12
♂ 69655	AMNH	111	.....	67	35	47	15	14	7	5	13
♂ 69656	AMNH	97	.....	60	33	42	13	13	7	5	12
♀ 16693	SSNH	112	.....	75	36	48	15	15	7	5	13
P. cerroense											
♀ 11977	USNM	113	84	.....	37	45	16	16	7.5	6.5	14
♀ 24357	LMK	114	80	.....	35	46	16	16	8	5	14
♂ 17370	SSNH	105	70	.....	30	46	16	16	8	5	14
♀ 17369	SSNH	75	53	.....	26	32	13	12	6	4	11
P. taurus											
♀ 22246	EHT	62	54	33	29	37	13	13	7	6	12
♂ 23987	EHT	87	71	49	35	50	16	17	8	7	16
♀ 111368	USNM	78	66	39	31	42	15	18	8	7	15
♀ 46713	USNM	75	66	40	37	45	14	17	7	7	14
P. ditmarsi											
♂ 36022	USNM	105	77	49	42	52	19	23	9	10	20
♀ 36012	USNM	.....	61	45	35	44	16	19	7	8	17
♀ 557	AMNH	.....	78	51	41	50	18	22	8	9	20
P. boucardii											
♀ 111370	USNM	123	79	44	39	51	17	20	9	7	17

From actual measurements made on the specimens studied, I have computed the percentage relationships, according to the following formulae. In the tables the maximum, mean and minimum are recorded. Both male and female are included to show the effect of secondary sexual differences.

FORMULAE

Body	$\frac{\text{snout-vent}}{\text{total length}} \times 100 =$
Head	$\frac{\text{head width}}{\text{head length}} \times 100 =$
Eye-ear	$\frac{\text{eye-snout}}{\text{ear-snout}} \times 100 =$
Frontal	$\frac{\text{frontal width}}{\text{head width}} \times 100 =$
Arm-leg	$\frac{\text{arm length}}{\text{leg length}} \times 100 =$
Arm	$\frac{\text{arm length}}{\text{snout-vent}} \times 100 =$
Leg	$\frac{\text{leg length}}{\text{snout-vent}} \times 100 =$
Tail	$\frac{\text{tail length}}{\text{snout-vent}} \times 100 =$
Eye	$\frac{\text{eye-snout}}{\text{head length}} \times 100 =$

TABLE 3. Percentage measurements

	Body	Head	Eye-ear	Frontal	Arm-leg	Arm	Leg	Tail	Eye
P. p. calidiarum									
Max.	♀ 72.4	100.0	63.6	86.8	85.4	55.5	70.0	58.9	53.9
	♂ 66.7	107.0	64.4	88.3	91.0	57.5	76.5	69.1	53.4
Mean.	♀ 67.5	95.9	53.3	79.5	77.4	44.0	61.6	52.0	42.7
	♂ 63.5	96.1	55.9	80.8	76.2	50.1	65.9	57.3	47.9
Min.	♀ 63.5	87.5	46.1	70.6	68.8	41.8	54.0	42.5	40.0
	♂ 58.1	84.8	46.1	73.4	67.4	44.6	60.3	45.5	41.2
P. p. platyrhinos									
Max.	♀ 75.5	109.0	61.5	90.0	83.0	51.0	74.0	52.0	56.0
	♂ 70.0	106.5	60.0	86.7	93.0	57.0	70.0	63.0	53.4
Mean.	♀ 68.9	96.9	56.2	79.0	77.2	45.7	59.5	44.4	48.9
	♂ 64.3	97.4	53.5	78.1	76.3	48.3	63.2	55.5	47.9
Min.	♀ 65.0	89.0	46 7	70.6	71 5	41.0	52.5	32 6	41.6
	♂ 61.0	87.5	46.7	68.8	67.0	42.0	52.0	40.0	40.0
P. m'callii									
Max.	♀ 70.6	100.0	66.6	93.0	84.5	54.2	71.5	65.0	53.9
	♂ 70.1	107.6	66.6	93.3	83.3	58.1	71.0	63.0	52.8
Mean.	♀ 66.3	91.4	58.5	83.4	76.1	48.5	62.9	51.0	46.1
	♂ 64.7	90.3	58.7	84.3	75.6	49.7	65.3	55.3	45.9
Min.	♀ 60.5	81.4	53.9	66.8	68.0	37.4	55.0	41.7	37.5
	♂ 61.4	85.8	53.3	76.6	68.0	44.2	57.9	50.0	41.2
P. modestum									
Max.	♂ 70.8	116.6	66.6	90.0	93.5	58.4	75.0	75.0	60.0
	♀ 72.4	115.1	64.5	91.0	90.5	60.0	70.6	53.4	63.6
Mean.	♂ 62.7	103.2	56.0	79.2	79.1	52.2	66.1	57.7	51.5
	♀ 68.8	104.8	57.4	79.1	83.4	50.9	60.9	43.6	54.9
Min.	♂ 55.2	92.8	44.4	71.5	72.0	43.5	55.5	47.7	40.1
	♀ 62.9	98.1	45.6	62.3	75.0	45.4	54.0	38.3	48.3

TABLE 4. Percentage measurements

		Body	Head	Eye-ear	Frontal	Arm-leg	Arm	Leg	Tail	Eye
P. c. frontale										
Max.	♀	75.5	112.0	64.0	70.0	87.5	47.4	59.1	46.8	53.0
	♂	72.0	117.5	60.0	72.2	81.4	52.2	67.5	60.0	58.0
Mean.	♀	71.9	103.0	55.0	64.7	78.6	43.1	54.5	39.7	49.7
	♂	67.6	105.7	54.7	67.6	75.5	45.9	61.1	48.1	50.7
Min.	♀	69.5	95.0	50.0	58.0	71.0	39.0	50.0	32.3	45.5
	♂	62.5	89.0	50.0	55.0	70.1	38.2	51.8	38.8	45.0
P. c. blainvillii										
Max.	♀	74.0	117.8	58.0	73.3	85.0	49.5	62.5	48.4	58.0
	♂	68.0	105.5	62.5	75.0	81.0	48.7	67.5	65.0	55.6
Mean.	♀	70.2	104.0	54.1	66.1	77.0	44.1	57.2	43.8	50.3
	♂	63.7	99.2	54.8	68.1	75.1	46.1	61.3	57.3	49.6
Min.	♀	67.5	95.0	50.0	60.0	71.8	40.2	52.0	37.4	45.0
	♂	60.6	91.0	50.0	61.2	68.0	41.8	53.5	46.8	44.5
P. c. schmidti										
Max.	♀	71.2	100.0	60.0	76.5	86.5	49.5	57.5	49.5	56.2
	♂	65.5	100.0	64.2	73.3	78.0	48.5	64.0	59.0	56.2
Mean.	♀	68.6	98.1	56.1	69.6	81.2	43.8	53.9	45.8	51.0
	♂	64.2	96.6	58.5	70.2	74.8	47.1	63.3	58.0	52.1
Min.	♀	66.5	94.1	53.0	61.8	72.5	41.6	50.5	40.3	47.0
	♂	63.5	95.0	55.6	68.5	71.4	45.5	62.5	56.8	50.0
P. c. jamesi										
Max.	♀	70.5	95.0	57.1	86.8	75.5	46.2	60.5	58.5	52.6
	♂	65.0	105.0	57.1	82.5	80.0	51.4	64.4	66.0	50.0
Mean.	♀	68.5	93.4	51.5	73.7	74.0	43.1	57.2	45.6	44.8
	♂	63.5	93.5	54.3	75.5	76.6	47.3	61.7	57.6	46.8
Min.	♀	63.0	88.3	40.0	72.2	72.0	36.5	50.0	41.7	35.3
	♂	60.2	84.0	50.0	63.1	73.0	45.7	60.0	53.5	44.5

TABLE 5. Percentage measurements

	Body	Head	Eye-ear	Frontal	Arm-leg	Arm	Leg	Tail	Eye
P. c. coronatum									
Max.	♀ 71.5	104.5	60.0	80.0	83.5	52.4	65.7	52.4	50.0
	♂ 66.5	100.0	62.5	93.4	81.0	50.8	65.0	60.0	52.6
Mean.	♀ 68.2	90.8	55.9	71.3	77.7	47.7	61.3	47.4	46.6
	♂ 64.3	91.4	56.1	76.3	75.1	47.4	62.4	55.5	47.9
Min.	♀ 65.6	79.0	52.6	54.2	69.0	42.3	57.5	42.5	41.2
	♂ 62.5	79.0	53.4	64.8	66.0	42.7	60.5	50.6	44.4
P. asio									
Max.	♀ 66.7	110.0	56.2	83.3	88.4	54.9	70.2	62.0	55.0
	♂ 64.5	100.0	56.2	82.9	80.5	52.9	65.0	74.3	55.0
Mean.	♀ 64.0	96.1	51.9	73.4	81.6	49.7	61.3	56.4	49.1
	♂ 55.7	98.0	53.3	78.5	76.9	49.1	62.6	67.7	52.0
Min.	♀ 61.7	90.0	43.7	60.0	72.4	43.9	56.6	50.0	41.2
	♂ 41.0	94.5	52.4	71.5	67.7	40.7	60.5	54.9	50.0
P. cornutum									
Max.	♀ 76.7	109.6	58.3	87.7	90.0	32.8	32.4	56.2	69.9
	♂ 75.1	112.6	61.7	81.5	88.5	33.2	35.0	55.8	70.0
Mean.	♀ 72.8	101.5	49.0	74.1	80.1	27.5	28.5	48.8	60.7
	♂ 68.4	103.6	49.4	73.2	77.7	26.7	28.8	49.8	64.1
Min.	♀ 68.5	94.4	42.1	66.7	71.2	23.3	24.3	40.6	52.5
	♂ 59.4	96.0	42.8	66.3	68.9	22.5	25.0	44.6	55.8
P. solare									
Max.	♀ 78.9	108.5	64.2	82.7	89.4	53.6	62.4	40.0	47.4
	♂ 68.0	95.2	62.6	80.0	82.5	60.0	62.5	57.4	45.4
Mean.	♀ 73.3	98.1	55.7	70.8	83.5	44.3	53.2	36.2	42.1
	♂ 66.4	88.0	56.2	72.5	76.0	46.0	58.4	50.7	41.5
Min.	♀ 71.4	87.5	47.4	63.2	77.5	38.2	42.6	26.9	38.8
	♂ 63.5	81.0	53.0	61.2	68.8	38.8	53.2	47.5	39.1

TABLE 6. Percentage measurements

		Body	Head	Eye-ear	Frontal	Arm-leg	Arm	Leg	Tail	Eye
P. d. douglassii										
Max.	♀	74.5	131.0	60.0	66.6	93.0	52.5	66.0	51.0	58.4
	♂	67.0	122.0	55.0	66.5	76.0	50.0	66.0	58.0	55.0
Mean	♀	70.9	118.1	52.7	61.1	81.1	45.2	56.6	41.3	54.7
	♂	65.2	120.0	52.5	65.1	73.7	45.8	62.2	52.5	54.7
Min.	♀	66.5	108.0	46.1	53.0	67.5	35.0	47.0	34.0	45.5
	♂	63.5	118.0	50.0	63.6	71.5	41.7	58.5	47.0	54.5
P. d. ornatum										
Max.	♀	72.5	130.0	55.6	70.5	81.1	46.7	61.5	46.5	58.0
Mean	♀	70.7	120.1	43.8	57.8	73.8	41.1	54.8	42.0	49.8
Min.	♀	69.6	101.2	40.0	52.4	66.7	37.5	50.0	38.0	46.2
P. d. hernandesi										
Max.	♀	72.0	143.0	52.7	60.7	86.3	47.4	65.7	53.0	58.9
	♂	67.0	143.0	53.4	58.4	81.6	50.0	65.4	58.4	57.0
Mean	♀	69.6	126.7	47.5	56.1	76.7	43.9	56.7	44.6	50.4
	♂	65.1	125.4	50.5	54.6	78.1	48.3	61.2	53.7	52.5
Min.	♀	65.6	113.8	42.1	47.8	71.8	36.5	47.6	36.9	44.4
	♂	63.1	111.6	47.0	50.0	74.5	44.8	53.8	49.4	47.0
P. d. ornatissimum										
Max.	♀	74.2	131.1	50.0	61.1	83.4	47.0	59.5	50.0	56.2
	♂	70.1	133.2	56.5	64.4	85.7	53.8	64.8	54.8	54.2
Mean	♀	70.1	123.8	47.5	57.6	76.8	44.7	56.2	43.2	52.5
	♂	67.2	117.4	52.2	60.7	83.3	50.6	60.7	48.9	51.9
Min.	♀	66.7	120.2	44.4	52.2	76.6	43.1	53.5	34.6	50.0
	♂	64.5	106.0	50.0	61.2	77.8	48.0	57.6	42.8	50.0

TABLE 7. Percentage measurements

	Body	Head	Eye-ear	Frontal	Arm-leg	Arm	Leg	Tail	Eye
P. d. brevirostre									
Max.	♀ 77.5	141.0	53.4	66.8	87.2	48.4	66.0	46.6	57.1
	♂ 67.5	133.0	58.4	66.8	86.0	52.3	64.5	70.4	63.5
Mean	♀ 70.9	127.4	50.6	56.6	80.9	43.0	53.3	41.5	53.9
	♂ 65.4	119.0	53.2	62.1	80.6	43.0	59.4	54.7	53.6
Min.	♀ 68.0	113.0	47.0	52.6	73.0	38.6	49.4	36.8	50.0
	♂ 60.1	108.0	46.1	57.1	74.0	40.0	54.0	48.2	46.7
P. o. orbiculare									
Max.	♀ 72.0	122.0	53.4	66.6	85.0	49.3	66.2	61.6	55.6
	♂ 67.0	112.7	53.4	73.5	81.0	52.8	65.2	77.8	52.6
Mean	♀ 66.5	108.9	49.5	56.6	77.2	43.7	56.9	50.7	48.3
	♂ 61.4	104.1	52.1	61.7	76.4	47.1	61.6	62.9	48.1
Min.	♀ 62.0	100.0	39.0	50.0	67.5	38.2	49.4	39.0	36.8
	♂ 56.4	94.1	47.0	55.5	73.0	41.2	56.1	49.2	42.0
P. o. cortezii									
Max.	♀ 69.0	119.0	54 0	64.0	87.0	52.0	60.8	55.4	53.0
	♂ 62.6	117.5	53.4	62.2	81.5	50.0	63.2	65.2	53.2
Mean	♀ 66.3	114.4	50.8	56.6	77.2	43.5	56.6	50.8	49.2
	♂ 61.9	112.9	49.7	59.8	78.7	46.3	58.2	61.7	48.4
Min.	♀ 62.8	107.0	46.0	52.4	73.2	36.0	49.2	44.8	45.2
	♂ 60.5	108.7	47.0	58.0	75.2	41.7	55.0	60.0	44.5

LITERATURE CITED

ALLEN, M. J.
1933 Report of a collection of amphibians and reptiles from Sonora, Mexico, with the description of a new lizard. Occas. Papers Mus. Zool. Univ. Michigan, no. 259, 1933, pp. 1-15.

ANDERSON, O. I., and J. B. SLATER
1941 Life zone distributions of the Oregon reptiles. Occas. Papers Dept. Biol. Coll. Puget Sound, no. 15, 1941, pp. 109-119.

ATSATT, SARAH R.
1913 The reptiles of the San Jacinto area of southern California. Univ. California Publ. Zool., vol. 12, 1913, pp. 31-50.

BAILEY, VERNON
1905 Biological survey of Texas. North America Fauna, no. 25, 1905, pp. 1-222.

BAIRD, SPENCER F., and CHARLES GIRARD
1852 Characteristics of some new reptiles in the museum of the Smithsonian Institution. Proc. Acad. Nat. Sci. Philadelphia, vol. 6, 1852, pp. 68-70.
1854 In Marcy & McClellan's exploration of the Red River of Louisiana, in the year 1852. App. F, reptiles, 1854, pp. 203-232.
1859 Reports of the explorations and surveys to ascertain the most practicable and economic route to the Pacific Ocean vol. 10, 1859, pp. 37-45.

BELL, THOMAS ESQ.
1829 The description of a new species of *Agama*, brought from the Columbia River by Mr. Douglas. Trans. Linn. Soc. London, vol. 16, pt. 1, 1829, pp. 105-107, tab. 10.

BLAINVILLE, H. O. DE
1835 Description de quelques espèces de reptiles de la Californie, précédée de l'analyse du systéme générál d'erpétologie et d'amphibiologie. Nouv. Ann. Mus. d'Hist. Natur., Paris, 1835, vol. 4, 284-348.

BLATCHLEY, W. S.
1893 Collection of batrachia and reptiles from Mt. Orizaba, Mexico, with the description of two new species. Proc. U. S. Nat. Mus. vol. 16, no. 922, 1893, pp. 37-42.

BOCOURT, MARIE FERMIN
1874 Mission Scientifique au Mexique et dans l'Amérique Centrale, Études sur les reptiles, livr. 4, 1874, pp. i-xiv, 1-494, pls. 1-22.

BOGERT, CHARLES M.
1930 An annotated list of the amphibians and reptiles of Los Angles Co., California. Bull. Southern California Acad. Sci., vol. 29, 1930, pp. 3-14.

BOGERT, CHARLES M., and J. A. OLIVER
1945 A preliminary analysis of the herpetofauna of Sonora. Bull. Amer. Mus. Nat. Hist., vol. 83, 1945, pp. 303-425.

BOULENGER, GEORGE ALBERT
1885 Catalogue of the Lizards in the British Museum (Natural History), vol. 2, 1885, pp. 1-497.

BOULENGER, E. G.
1916 A new lizard of the genus *Phrynosoma* recently living in the societies gardens. Proc. Zool. Soc. London, 1916, p. 537, pl. 1, figs. 1-3.

BRENNEN, L. A.
1938 A study of the habitat of the reptiles and amphibians in Ellis Co., Kansas. Trans. Kansas Acad. Sci. vol. 40, 1838, pp. 341-347.

BREUKELMAN, JOHN, and T. A. DOWNS
1936 A list of the amphibians and reptiles of Chase and Lyon Cos., Kansas. Trans. Kansas Acad. Sci., vol. 39, 1936, pp. 267-268.

BROOM, ROBERT
1948 Notes on the skull of the American horned lizards, *Phrynosoma*. Anal. Transv. Mus., vol. 21, 1948, pp. 43-45, fig. 1.

BRUNER, H. L.
1907 On the cephalic veins and sinuses of reptiles, with description of a mechanism for raising the venous pressure in the head. Amer. Jour. Anat., vol. 7, 1907, pp. 1-117, fig. 17, pls. 3.

BRYANT, HAROLD C.
1911 The horned lizards of California and Nevada of the genera *Phrynosoma* and *Anota*. Univ. California Publ. Zool., vol. 9, 1911, pp. 1-84, pl. 1-9.

BURLESON, G. L.
1942 Source of the blood ejected from the eye by the horned toad. Copeia, no. 4, 1942, pp. 246-248.

BURT, CHARLES E.
1928a Insect food of Kansas lizards with notes on feeding habits. Journ. Kansas Ent. Soc., vol. 1, 1928, pp. 50-68.

1928b The lizards of Kansas. Trans. Acad. Sci. St. Louis, vol. 26, no. 1, 1928, pp. 1-81, figs. 1-14.

1928c Key to the species of lizards in Kansas. Enterprise Press, 1928, pp. 1-2.

1932 The status of the horned lizard *Phrynosoma brevicornis*, described from Texas by E. G. Boulenger (1916). Proc. Biol. Soc. Washington, vol. 45, 1932, pp. 73-74.

1933a Some distributional and ecological records of Kansas reptiles. Trans. Kansas Acad. Sci., vol. 36, 1933, pp. 186-208.

1933b Some lizards from the great basin of the west and adjacent areas, with comments on the status of various forms. Amer. Midl. Nat., vol. 14, 1933, pp. 228-250.

1935 Further records of the ecology and distribution of amphibians and reptiles in the middle west. Amer. Midl. Nat., vol. 16, 1935, pp. 311-366.

1937 The fauna: amphibians and reptiles of "Rock City." Trans. Kansas Acad. Sci., vol. 40, 1937, p. 195.

BURT, CHARLES E., and MAY DANHEIM BURT
1929 A collection of amphibians and reptiles from Mississippi Valley with field observations. Amer. Mus. Novitates, no. 381, 1929, pp. 1-14.

BURT, CHARLES E., and W. L. HOYLE
1934 Additional records of the reptiles of the central prairie region of the United States. Trans. Kansas Acad. Sci., vol. 37, 1934, pp. 193-216.

CAHN, A. R.
1926 The breeding habits of the Texas horned toad, *Phrynosoma cornutum*. Amer. Nat., vol. 60, 1926, pp. 546-551, figs. 1 & 2.

COPE, EDWARD D.
1864 Contributions to the herpetology of Tropical America. Proc. Acad. Nat. Sci. Philadelphia, vol. 16, 1864, pp. 166-182.

1873 Synopsis of new Vertebrate from the Tertiary of Colorado. U. S. Geol. Surv., 1873, pp. 16-19.

1875 Check List of the North American Batrachia and Reptilia. U. S. Nat. Mus. Bull. no. 1, 1875, pp. 1-104.

COPE, EDWARD D.
1896 On two new species of lizards from southern California. Amer. Nat., vol. 30, 1896, pp. 833-836.
(1900) The crocodilians, lizards and snakes of North America. Report U. S. Nat. Mus. for 1898 (1900), pp. i-xviii, 1-1270, pls. 1-36, figs. 1-347.

COWLES, RAYMOND B.
1939 Possible implications of reptiles' thermal tolerance. Science, vol. 90 (NS) 1939, pp. 465-466.

COWLES, RAYMOND B., and CHARLES M. BOGERT
1944 A preliminary study of the thermal requirements of desert reptiles. Bull. Amer. Mus. Nat. Hist., vol. 83, 1944, pp. 265-296.

CRAGIN, F. W.
1884 Notes on some southwestern reptiles in the cabinet of Washburn College. Bull. Washburn Lab. Nat. Hist., vol. 1, 1884, pp. 6-8.

CUVIER, M.
1817 Le règne animal distribue d'après son organisation, pour servir de base a l'histoire naturelle des animaux et d'introduction a l'anatomie comparee. Paris, vol. 2, 1817, pp. i-xviii, 1-532.

DELLINGER, S. C., and JOHN D. BLACK
1938 Herpetology of Arkansas. Occas. Papers Univ. of Arkansas Mus., no. 1, pt. 1, Reptiles, 1938, pp. 1-47.

DICE, L. R.
1943 The biotic provinces of North America. University of Michigan Press, 1943, pp. 1-78.

DITMARS, RAYMOND L.
1936 The Reptiles of North America. 1936, pp. i-xvi, 1-476, pls. 1-135.

DUGÈS, ALFREDO
1869 Catalogo de animales vertebrados observados in la república Mexicana. La Naturaleza, I, 1869-1870, pp. 137-145.

DUMÉRIL, A. M. C., and G. BIBRON
1837 Erpétologie Générale ou Histoire Naturelle des Reptiles, vol. 4, 1837, pp. 1-572.

DUMÉRIL, AUGUSTE, MARIE FERMIN BOCOURT, and F. MOCQUARD
1870-1895 Mission Scientifique au Mexique et dans l'Amérique Centrale, Études sur les reptiles, 1870-1895, pp. i-xiv, 1-1012, pl. 1-77.

DUNN, EMMETT R.
1936 Amphibians and reptiles of the Mexican expedition of 1934. Proc. Acad. Nat. Sci. Philadelphia, vol. 88, 1936, pp. 471-477.

EVENDER, F. G., JR.
1946 Notes on the herpetology of Elmore Co., Idaho. Copeia, no. 4, 1946, pp. 256-7.

FITCH, HENRY S.
1949 Study of snake populations in central California. Amer. Midl. Nat. vol. 41, no. 3, 1949, pp. 513-579.

FITZINGER, LEOPOLD I.
1826 Ein neue Classification der Reptilien. Wien, 1826, pp. 1-66, pl. 1.
1843 Systema Reptilium, 1843, pp. 1-106.

FRIERSON, L. S., JR.
1927 *Phrynosoma cornutum* (Harlan) in Louisiana. Copeia, no. 165, 1827, p. 144.

GADOW, H.
1905 Distribution of the Mexican amphibians and reptiles. Proc. Zool. Soc. London, 1905, pp. 191-244.

GARMAN, S. W.
1887 Reptiles and batrachians from Texas and Mexico. Bull. Essex Inst. vol. 19, 1887, pp. 119-138.

GILMORE, CHARLES W.
1928 Fossil lizards of North America. Mem. Nat. Acad. Sci., vol. 22, 1928, pp. i-ix, 1-169, text figs. 1-105, pls. 1-27.
1941 Some little-known fossil lizards from the Oligocene of Wyoming. Proc. U. S. Nat. Mus., vol. 91, 1941, pp. 71-76, figs. 30-32.

GIRARD, CHARLES
1852 Monographic essay on the genus *Phrynosoma*, *in* Stansbury's exploration and survey of the Valley of the Great Salt Lake of Utah. 1852, pp. 354-365.
1853 List of the reptiles collected in California by John L. Le Conte, with descriptions of new species. Proc. Acad. Nat. Sci. Philadelphia, 1853, pp. 1-300.
1858 In the U. S. exploring expedition during the years 1838, 1839, 1840, 1841, 1842 under the command of Charles Wilkes USN, vol. 20, 1858, Herpetology, p. i-xvii, 1-496, Atlas.

GLOYD, HOWARD K.
1937 The Chicago Academy of Sciences Arizona expedition April-June 1937. Progr. Act. Chicago Acad. Sci., vol. 6, no. 2, 1937, pp. 3-26, figs. 1-14.
1937 A herpetological consideration of the faunal areas in southern Arizona. Bull. Chicago Acad. Sci., vol. 5, 1937, pp. 79-136, figs. 1-21.

GORDON, K.
1939 Amphibians and reptiles of Oregon. Oregon State Mono. Std. Zool., no. 1, 1939, pp. 1-82.

GRAF, W., and S. G. JEWELL, JR., and K. L. GORDON
1939 Records of the amphibians and reptiles from Oregon. Copeia, no. 2, 1939, pp. 101-104.

GRAY, J. E.
1825 A synopsis of the genera of the reptiles and amphibia, with a description of some new species. Ann. Philos., N. S., vol. 26, 1825, pp. 193-217.
1831 A synopsis of the species of the class reptilia. Appendix in Griffith's Cuvier's Animal Kingdom, vol. 9, 1831, pp. 1-110.
1839 Reptiles in Richardson's Zoology of Beechey's voyage to the Pacific, 1839, pp. 1-105, pls. 1-35.
1845 Catalogue of the specimens of the lizards in the collection of the British Museum. 1845, pp. i-xxviii, 1-289.

GRINNELL, JOSEPH
1908 The biota of the San Bernardino Mountains. Univ. California Publ. Zool., vol. 5, 1908, pp. 1-170.

GRINNELL, JOSEPH, and CHARLES L. CAMP
1917 A distributional list of the amphibians and reptiles of California. Univ. California Publ. Zool., vol. 17, 1917, pp. 127-208, 14 text figs.

GUNTHER, A. C. L. G.
1885-1902 Biologia Centrali-Americana; Reptilia and Batrachia, 1885-1902, pp. i-xx, 1-326, pls. 1-76.

HALLOWELL, EDWARD
1852 Description of new species of reptiles inhabiting North America. Proc. Acad. Nat. Sci., Philadelphia, vol. 6, 1852, p. 183.

HARLAN, RICHARD
1825 Description of two new species of *Agama*. Journ. Acad. Nat. Sci. Philadelphia, vol. 4, 1825, pp. 296-304, pl. 30.

HARTWEG, N., and J. A. OLIVER
1940 A contribution to the herpetology of the Isthmus of Tehuantepec IV. Misc. Publ. Mus. Zool. Univ. Michigan, no. 47, 1940, pp. 7-31.

HERNANDEZ, FRANCOIS
1615 Plantas Y Animales de la Neuva Espana . . ., 1615, pp. 1-327, fig (unnumbered). (Ximenes translation and abridgement).

HEWATT, WILLIS G.
1937 Courting and egg-laying habits of *Phrynosoma cornutum*. Copeia, no. 4, 1937, p. 234.

HUDSON, G. E.
1942 The amphibians and reptiles of Nebraska. Neb. Cons. Bull. no. 24, 1942, pp. 1-146, pls. 1-2, maps 1-32.

KLAUBER, LAURENCE M.
1932a The flat-tailed horned toad in Lower California. Copeia, no. 2, 1932, p. 100.
1932b Amphibians and reptiles observed enroute to Hoover Dam. Copeia, no. 2, 1932, pp. 118-128.
1934 An annotated list of the amphibians and reptiles of the southern border of California. Bull. Zool. Soc. San Diego no. 11, 1934, pp. 1-28, figs. 1-7.
1935 The status of the Sonoran horned toad *Phrynosoma goodei* Stejneger. Copeia, no. 4, 1935, pp. 178-179.
1936 Horned toads of the *coronatum* group. Copeia, no. 3, 1936, pp. 103-110, figs. 1-2.
1939 Studies of reptile life in the arid southwest. Bull. Zool. Soc. San Diego, no. 14, 1939, pp. 1-100, tabs. 1-15.

KNOWLTON, GEORGE F., and M. J. JANES
1934 Distributional and food habits notes on Utah lizards. Copeia, no. 1, 1934, p. 10.

KNOWLTON, GEORGE F., and W. L. THOMAS
1936 Food habits of Skull Valley lizards. (Tooele Co., Utah.) Copeia, no. 1, 1936, pp. 64-66.

LAURENTI, JOSEPH NICOLAI
1768 Specimen medicum, exhibens synopsin reptilium, 1768, pp. 1-8 (unnumbered), 1-214, 1-3 (unnumbered), pls. 1-5.

LINNAEUS, CAROLUS
1766 Systema naturae. Vol. 1, ed. 12, 1766, pp. 1-532.

LINSDALE, JEAN M.
1932 Amphibians and reptiles from Lower California. Univ. California Publ. Zool., vol. 38, 1932, pp. 345-386.
1940 Amphibians and reptiles in Nevada. Proc. Amer. Acad. Arts & Sci. vol. 73, 1940, pp. 197-257.

LITTLE, ELBERT L., and JOHN G. KELLER
1937 Amphibians and reptiles of the Jornada experimental range, New Mexico. Copeia, no. 4, 1937, pp. 216-222.

LOCKINGTON, W. N.
1880 List of the Californian reptiles and Batrachia collected by Mr. Dunn and Mr. W. L. Fraber. American Nat., vol. 14, 1880, pp. 295-296.

LOCKWOOD, S.
1883 Maternal anxiety in a horned toad. American Naturalist, vol. 17, 1883, p. 682.

MCLAIN, ROBERT B.
1899 Contributions to neotropical herpetology. Wheeling W. Va. (Privately printed). Pp. 1-5.

MARR, J. C.
1944 Notes on the amphibians and reptiles from the central United States. Amer. Midl. Nat., vol. 32, 1944, pp. 478-490.

MEARNS, EDGAR A.
1907 Mammals of the Mexican boundary of the United States. Bull. U. S. Nat. Mus., no. 56, pt. 1, 1907, pp. i-xv, 1-530.

MEEKS, S. E.
1905 An annotated list of a collection of reptiles from southern California and northern Lower California. Field Columbian Mus. Zool., ser. 7, 1905, pp. 1-19.

MILLER, LOYE
1948 An enemy of the horned lizard. Copeia, no. 1, 1948, p. 67.

MILNE, L. J.
1938 Mating of *Phrynosoma cornutum*. Copeia, no. 4, 1938, pp. 200-201.

NORRIS, K. S.
1949 Observations of the habits of the horned lizard *Phrynosoma*. Copeia, no. 3, 1949, pp. 176-180.

OKEN, LORENZ
1816 Lehrbuch der Naturgeschichte. Dritter Theil. Zoologie zweite Abteilung. Fleischthiere. Jena, 1816, pp. 1-1270.

ORTENBURGER, A. I.
1926a A report on the amphibians and reptiles of Oklahoma. Proc. Oklahoma Acad. Sci., vol. 6, 1926, pp. 89-100.

1926b Field observations on some amphibians and reptiles of Pima Co., Arizona. Proc. Oklahoma Acad. Sci., vol. 6, 1926, pp. 101-121.

1926c Reptiles and amphibians collected in the Wichita Mts., Comanche Co., Oklahoma. Copeia, no. 155, 1926, pp. 137-138.

1927 A list of reptiles and amphibians from the Oklahoma Panhandle. Copeia, no. 163, 1927, pp. 46-48.

OVER, WILLIAM H.
1923 Amphibians and reptiles of South Dakota. South Dakota Geol. Nat. Hist. Surv., Bull. 12, ser. 23, no. 10, 1923, pp. 1-34.

OWEN, R. P.
1940 A list of reptiles of Washington. Copeia, no. 3, 1940, pp. 169-172.

PETERS, W.
1873 Über neue Saurier (*Sphaeriodactylus, Anolis, Phrynosoma, Tropidolepisma, Lygosoma, Ophioscincus*) aus Centraliamerica, Mexico und Australien, Monats. Akad. Wiss. Berlin, 1873, pp. 738-747.

QUAINTANCE, C. W.
1935 Reptiles and amphibians from Eagle Creek, Greenlee Co., Arizona. Copeia, no. 4, 1935, pp. 183-185.

REESE, A. M.
1922 Egg-laying by the "horned toad" *Phrynosoma cornutum*. Copeia, no. 103, 1922, pp. 15-16.

RUTHVEN, A. G.
1932 Notes on the amphibians and reptiles of Utah. Occas. Papers Mus. Zool. Univ. Michigan, no. 243, 1932, pp. 1-4.

SEBA, ALBERT
1734 Locupletissimi rerum naturalium thesauri accurati descriptio, et iconibus artificiosissimis expressio, per universam physices historiam, vol. 1, 1734, pp. 1-36 (unnumbered), 1-178, pls. i-iii.

SCHMIDT, KARL P.
1922 The amphibians and reptiles of Lower California and neighboring islands. Bull. Amer. Mus. Nat. Hist., vol. 46, 1922, pp. 607-707.

SCHMIDT, KARL P., and D. W. OWENS
1944 The amphibians and reptiles of northern Coahuila, Mexico. Zool. Series Field Mus. Nat. Hist., vol. 29, 1944, pp. 97-115.

SCHMIDT, K. P. and F. A. SHANNON
1947 Notes on amphibians and reptiles of Michoacan, Mexico. Fieldiana Zoology, Published by Chicago Nat. Hist. Mus., vol. 31, 1947, pp. 63-85.

SMITH, CHARLES C., and GERALD ACKER
1940 A collection of reptiles from Logan Co., Oklahoma. Proc. Oklahoma Acad. Sci., vol. 20, 1940, p. 65.

SMITH, C. F.
1941 Birth of horned toads. Copeia, 1941, p. 114.

SMITH, HOBART M.
1934 Notes on some lizards of the genus *Phrynosoma* from Mexico. Trans. Kansas Acad. Sci., vol. 37, 1934, pp. 287-297, pl. 11 & 12.

1939a An annotated list of the Mexican amphibians and reptiles in the Carnegie Museum. Ann. Carnegie Mus., vol. 27, 1939, pp. 311-320.

1939b Notes on Mexican reptiles and amphibians. Field Mus. Nat. Hist. Zool. Ser., vol. 24, 1939, no. 4, pp. 15-35, fig. 4.

1939c The Mexican and Central American lizards of the genus *Sceloporus*. Field Mus. Nat. Hist. Zool. Ser., vol. 26, 1939, pp. 1-397, pls. 1-31, figs. 1-59.

1940 An analysis of the biotic provinces of Mexico, as indicated by the distributions of the lizards of the genus *Sceloporus*. Anales de la Escuela Nacional de Ciencias Biologicas vol. 2, 1940, pp. 95-110.

1942 Mexican herpetological miscellany. Proc. U. S. Nat. Mus., vol. 92, 1942, pp. 349-395.

1946 Handbook of lizards. Comstock Publishing Co., 1946, pp. i-xxi, 1-557, pls. 1-135, text figs. 1-136, maps 1-41.

SMITH, HOBART M., and M. B. MITTLEMAN
1943 Notes on the Mansfield Museum's Mexican reptiles collected by Wilkinson. Trans. Kansas Acad. Sci., vol. 46, 1943, pp. 243-249.

SMITH, HOBART M., and L. E. LAUFE
1945 Mexican amphibians and reptiles in the Texas co-operative wildlife collection. Trans. Kansas Acad. Sci., vol. 48, no. 3, 1945, pp. 325-354.

SMITH, HOBART M., and EDWARD H. TAYLOR
1950a Type localities of Mexican reptiles and amphibians. Univ. Kansas Sci. Bull., vol. 33, pt. 2, 1950, pp. 313-380.

1950b Check list of the lizards of Mexico. Bull. U. S. Nat. Mus., no. 199, 1950, pp. 1-253.

STEBBINS, ROBERT C.
1943 Adaptations in the nasal passages for sand burrowing in the saurian genus *Uma*. Amer. Nat. vol. 77, 1943, pp. 38-52.

STEJNEGER, LEONHARD
1890 Annotated list of the reptiles and batrachians collected by Dr. C. Hart Marriam and Vernon Bailey on the San Francisco mountain plateau and desert of Little Colorado, Arizona, with descriptions of new species. North Amer. Fauna, no. 3, 1890, pp. 112-115, pl. 12, figs. 3a-c, 4a-c.

1893 Annotated list of the reptiles and batrachia collected by the Death Valley expedition in 1891, with descriptions of new species. N. Amer. Fauna, no. 7, 1893, pp. 159-228, pls. 1-3.

1906 A new lizard of the genus *Phrynosoma*, from Mexico. Proc. U. S. Nat. Mus., vol. 29, 1906, pp. 565-567.

1919 The name of the horned toad from Salt Lake Basin. Copeia, no. 65, 1919, pp. 3-4.

STONE, WITMER, and J. A. B. REHN
1903 On the terrestrial vertebrates of portions of southern New Mexico and western Texas. Proc. Acad. Nat. Sci. Philadelphia, 1903, pp. 16-34.

STONE, WITMER
1911 On some collections of reptiles and batrachians from the western United States. Proc. Acad. Nat. Sci. Philadelphia, 1911, pp. 222-232.

STRECKER, JOHN K.
1908 The reptiles and batrachians of Victoria and Refugio Cos., Texas. Pro. Biol. Soc. Washington, vol. 21, 1908, pp. 47-52.
1926 A list of reptiles and amphibians collected by Louis Barni in vicinity of Boerne, Texas. Contr. Baylor Univ. Mus. no. 6, 1926, pp. 1-9.
1927 Observations of the food habits of Texas amphibians and reptiles. Copeia, no. 162, 1927, pp. 6-9.
1928 Common English and folk names for Texas amphibians and reptiles. Contr. Baylor Univ. Mus., no. 16, 1928, pp. 1-21.

STRECKER, JOHN K., and L. S. FRIERSON
1926 The herpetology of Caddo and De Soto parishes, Louisiana. Contr. Baylor Univ. Mus., no. 5, 1926, pp. 1-5 (unnumbered).

STRECKER, JOHN K., and W. J. WILLIAMS
1935 Notes on the zoology of Texas. Baylor Univ. Bull., vol. 38, 1935, pp. 1-69.

STUART, L. C.
1932 The lizards of the middle Pahvant Valley, Utah; materials for a study in saurian distribution. Occas. Papers Mus. Zool. Univ. Michigan, no. 244, 1932, pp. 1-33, pls. 1-4.

SVIHLA, ARTHUR, and R. D. SVIHLA
1933 Amphibians and reptiles of Whitman Co., Washington. Copeia, no. 3, 1933, p. 125.

TAYLOR, EDWARD H., and I. W. KNOBLOCH
1940 Report on a herpetological collection from the Sierra Madre Mts. of Chihuahua. Proc. Biol. Soc. Washington, vol. 53, 1940, pp. 125-130.

TEVIS, LLOYD
1944 Herpetological notes from Lower California. Copeia, no. 1, 1944, pp. 6-18, figs. 1 & 2.

VAN DENBURGH, JOHN
1893-1894 Description of three new lizards from California and Lower California with a note on *Phrynosoma blainvillii*. Proc. California Acad. Sci., ser. 2, vol. 4, 1893-1894, pp. 296-301.
1894 *Phrynosoma solaris*, with a note on its distribution. Proc. California Acad. Sci., ser. 2, vol. 4, 1894, p. 456.
1897 The reptiles of the Pacific Coast and Great Basin. Occas. Papers California Acad. Sci., no. 5, 1897, pp. 1-236.
1922 The reptiles of western North America. Vol. 1, lizards. Occas. Papers California Acad. Sci., no. X, 1922, pp. 1-611, pls. 1-57.
1924 Notes on the herpetology of New Mexico with list of species known from that state. Proc. California Acad. Sci., ser. 4, vol. 13, 1924, pp. 189-230.

VAN DENBURGH, JOHN, and JOSEPH R. SLEVIN
1921 List of the amphibians and reptiles of Idaho, with notes on the species in the collection of the academy. Proc. California Acad. Sci., ser. 4, vol. 11, 1921, pp. 39-47.

VORHIES, C. T.
1948 Food items of rattlesnakes. Copeia, no. 4, 1948, p. 303.

WAGLER, J.
1830 Naturliches System der Amphibien. Munchen, Stuttgart, and Tubigen, 1830, pp. 1-354.

WIEGMANN, A. FRIEDRICH
1828 Beytrage zur Amphibienkunde. Isis von Oken, vol. 21, pt. 3-4, 1828, pp. 364-383.
1834 Herpetologia Mexicana, 1834. Pp. i-vi, 1-54. pls. I-X.

WINTON, W. M.
1917 Habits and behavior of the Texas horned lizards, *Phrynosoma cornutum* Harlan. Copeia, no. 39, 1917, pp. 7-8.

WOOD, S. F.
1936 Courting and behavior of some western lizards. Copeia, no. 3, 1936. P. 177.

YARROW, H. C.
1875 Report upon a collection of batrachians and reptiles made in portions of Nevada, Utah, California, Colorado, New Mexico and Arizona, during the years 1871, 1872, 1873, and 1874. Rept. Geog. and Geol. Exp. and Sur. west 100th Merid. vol. 5, Zool., 1875, pp. 509-633.