

## HISTORICAL PERSPECTIVES

Life Habits of *Phrynosoma*<sup>1</sup>

In a recent number of the 'Zoölogischen Anzeiger' Prof. Charles L. Edwards, of the University of Cincinnati, gives the following interesting notes upon the habits of the horned lizards of Texas:

While living in Austin, Texas, from May, 1892, to July, 1894, I had abundant opportunity of verifying previous observations upon the life of *Phrynosoma*, and of adding some notes that, so far as I can find, have not been given before this paper.

*Phrynosoma cornutum* Harlan, in Texan parlance the 'horny frog,' is easily approached under the natural conditions of its habitat, and with a plentiful supply of live flies I have had no difficulty in keeping from fifty to one hundred of them confined in vivaria for many weeks at a time. Six months of the hot, dry, Texas summer, with long days under the glaring sun, and the ground covered with a layer of fine, limestone dust, gives this species of *Phrynosoma* an ideal environment.

A review of the principal points concerning the biology of this familiar genus as brought out in the literature appended, and confirmed by myself, may be first presented. Not to go back to the original systematic descriptions of Wiegmann, Girard, Harlan, Hallowell, Bell, Gray and Blainville, or to mention the

synonymy from the various catalogues of reptiles, the taxonomic needs of this paper may be served by reference to Gentry's review of the genus *Phrynosoma*.

This cunning little Iguanid is harmless, never biting its captor, and soon becoming so tame that it may be trained to work in harness pulling a toy wagon, or to eat insects from one's hand. When gently rubbed it puffs itself out, but when in fear it becomes flattened to the ground. *Phrynosoma* chiefly enjoys a dust heap, where with tail and feet flirting the warm calcareous powder over its body, or with alternate sawing motions of its sides, it quickly buries all of itself save the head, and sometimes even this part, in the dirt. While built after an awkward pattern for a lizard, and generally moving slowly, yet it can, when alarmed, run rapidly. It is very clever at 'playing possum' and, aided by its protective coloring, often escapes from an enemy.

The food of *Phrynosoma* always consists of live animals — spiders, flies and especially ants. In Texas the agricultural ant

<sup>1</sup> Reprinted from *Science*, New Series, Vol. 3, No. 73 (22 May 1896, pp. 763–765).



WENDY L. HODGES

A dorsolaterally flattened body and fringes of scales along their sides allow Texas Horned Lizards (*Phrynosoma cornutum*) to blend effectively with a gravel/sand substrate. This is especially noticeable when they flatten themselves against the ground when frightened. This reduces the animal's shadow (very evident in this photo) and causes its outline to merge with the background, rendering them amazingly cryptic.

## Editor's Remarks

Everybody likes Horned Lizards (genus *Phrynosoma*). They are strange-looking but calm, rarely bite or even try to scurry away, and most are attractively colored. Unfortunately, most species are also declining despite local or federal protection over at least some of their ranges. The causes are complex, but primarily appear to involve habitat loss, invasive species such as the imported Fire Ant, chemical use in agricultural fields, and — at least historically — collection for pets (a problem even in the early part of the 20th Century as explicitly stated in one of the following notes). Considerable research is ongoing, and we hope to highlight several projects in the next few issues. Readers can find additional information and ways to become involved at the website of the Horned Lizard Conservation Society (<http://www.hornedlizards.org/>). The HLCS will be having its annual meeting in Texas later this year, and we will report on the topics covered in a future issue of *Iguana*. In the meantime, we have collected a series of short classics reporting on these fascinating creatures. One of the issues they cover is blood-squirting from the eyes, a defense mechanism primarily employed by the lizards against canid predators. Long enshrined in myth, this behavior came into question when early herpetologists were unable to elicit it. Only later did it become fully established that this does, indeed, occur.

Gad Perry  
Texas Tech University, Lubbock

(*Pogonomyrmex barbatus*) furnishes almost exclusively the diet of the horned frog. If, however, a quantity of ants are placed with the latter in a vivarium, they soon find thin places on the apparently tough, horny armor of their enemies, and by stinging they drive the horned frogs crazy and frequently to death. While having an abundant supply of water in the vivarium, I have never seen these lizards drink, although they are said to lap up drops of dew when in natural environment. The molting and the curious habit of ejecting blood from the eyes are phenomena often observed. The statement of Böttger that a voice is absent in *Phrynosoma* must be modified, for under certain conditions of excitement it utters a sharp squeak.

This lizard has always been given as viviparous. On the contrary, it builds a nest and lays eggs therein. The only time I observed the nest-building was on June 25, 1894. The location was on a stony clay bank at the side of an Austin street. When first seen, 6 p. m., the female was excavating a tunnel at an angle of about 75° to the surface of the ground, and wide and high enough to comfortably work in. She dug with her front feet, pushing back the loose earth and bits of stone with her hind feet until this debris was quite clear of the entrance. So absorbed was she in her work that my presence did not cause any alarm. The next morning I found the tunnel neatly filled again and the lizard gone.

After carefully removing the replaced debris, the tunnel was found to be seven inches deep. At the bottom, forming an L with this tunnel, was a narrow entrance leading into a chamber three and one-half inches in diameter and two inches high, which was quite round, except for two projecting stones. Here perfectly packed in with loose earth were twenty-five eggs, while again in a hole one and one-half inches deep, at the bottom of the tunnel, were fifteen more. Since the embryos of one of these sets were at a considerably more advanced stage, this female must have taken advantage of the excavation of another. At the time of ovulation the embryo, while at an advanced stage, is still not ready to hatch by probably some days or even weeks. This stage will be considered in detail in a later paper on the embryology of *Phrynosoma*.

Authors give the period of gestation as high as one hundred days in females kept in confinement, but while I have not complete data from coition to ovulation I believe that under natural conditions the time of carrying the eggs is much shorter. A female which had laid eggs in captivity in August, 1864, became very restless after the eggs were taken away. She tried constantly for two or three days to get out of the vivarium at the place where the wire screen had been raised to remove the eggs. Lockwood gives an instance of this maternal anxiety where a female attempts to distract the attention of an observer from her young.

## A Horned Lizard at a High Altitude<sup>2</sup>

T.D.A. Cockerell

On June 30, at the head of John's Cañon, Las Vegas Range, N. M., I was somewhat surprised to find a horned lizard in the uppermost part of the Canadian Zone, above 10,000 feet (the aneroid indicated 10,500, but is not quite reliable at that altitude). The species is *Phrynosoma hernandesii*<sup>3</sup> (Girard), and the specimen is dark gray, beneath white mottled with gray. The

top of the range is Hudsonian, and no lizards are found there.

<sup>2</sup> Reprinted from *Science*, New Series, Vol. 14, No. 342 (19 July 1901, p. 111).

<sup>3</sup> Mountain Short-horned Lizard, *Phrynosoma hernandesii*.



WENDY L. HODGES

Mountain Short-horned Lizards (*Phrynosoma hernandesi*) can be found at elevations over 3000 m.

## A Note on Distinction of the Sexes in *Phrynosoma*<sup>4</sup>

W.M. Winton

A surprisingly small amount of knowledge concerning the embryology and development of the Iguanidæ has been collected. One reason for this is the fact that, for most forms, there is no reliable method of distinguishing the sexes by external characters. This is particularly true in the case of the familiar, but little studied, “horned toad,” *Phrynosoma cornutum*, and undoubtedly many “pairs” which have been shipped north by well meaning collectors have been of the same sex.

In making a study of the stomach contents of *Phrynosomas*, I have had occasion to open some two hundred

specimens, trying always to find some connection between external characters and sex. The problem very quickly was solved; and I can affirm, that for this region at least, and during the spring months, the crescent markings on the back of the female are much brighter yellow than those of the male. The difference is very marked, and little or no practise is required to enable one to distinguish the sexes, even without comparison of specimens.

<sup>4</sup> Reprinted from *Science*, New Series, Vol. 40, No. 1026 (28 August 1914, pp. 311–312).

## An Examination of Blood-ejecting Horned Lizards<sup>5</sup>

W.M. Winton

The horned lizard’s (or horned “toad’s”) remarkable habit of ejecting blood from its eye when attacked, although well authenticated, is so rarely observed that it is thought by many to have its origin and its creditability in the little animal’s dragon-like appearance. Even Ditmars confesses that it took an actual demonstration, witnessed only after handling several hun-

dred specimens, to upset his skepticism. His description of the performance is well known.

<sup>5</sup> Reprinted from *Science*, New Series, Vol. 40, No. 1039 (27 November 1914, pp. 784–785).



WENDY L. HODGES

Texas Horned Lizards (*Phrynosoma cornutum*) share with all other Horned Lizards the capacity to eject blood from sinuses near the eyes. This appears to deter at least some potential predators.

Hay (1892), Stejneger (1893), Van Denburg (1897), Bunner (1907), Bryant (1911) and others have observed and mentioned this peculiar habit. It is not limited to any single species.

Various explanations have been suggested; among others that the phenomenon is connected with the breeding season, that it may be due to some parasite, and that it may be “a secondary use acquired by a relatively few forms.”

Bryant sectioned the eyelids of a blood-ejecting specimen, and found them highly vascular and full of blood sinuses.

On July 4, while collecting specimens of *Phrynosoma cornutum* for examination of stomach contents, I was fortunate

enough to witness this phenomenon. One of my students, walking by my side, stooped and thrust out his hand to pick up a large specimen, when he was met by a sudden spurt of blood coming unmistakably from the lizard’s eye. The blood spread over the young man’s hand in a fan shaped and even smear, extending from the second joint of the index finger to the wrist, and being about thirty mm. wide at the base. On July 7, another specimen, while being chloroformed, shot a quick jet of blood from one eye. The blood was given an almost explosive impulse, and formed a single thick drop on the inner wall of the bell jar. On July 20, another specimen ejected blood while being anesthetized. In this case, the blood on the wall of the bell jar was mixed with tiny fragments of skin and a few scales.

All three animals were subjected to a very careful examination. All were males. Their lengths were 108 mm., 110 mm. and 108 mm. The lizards were in good condition, even being free from tapeworms and other intestinal parasites with which local *Phrynosomas* are much infected. The stomach contents were characteristic, consisting of agricultural ants, small beetles, isopods, etc. In each case, the eye from which the blood was ejected showed a small quantity of clotted blood in the posterior corner. The vessels were slightly swollen. The cornea seemed to be intact. In the first two cases there was a small spot in the sclerotic coat, which can be best described as a blood blister. The contents on removal to a slide, and staining with Wright’s stain, showed nothing except a few red corpuscles and lymphocytes. The third specimen showed nothing but a mass of clotted blood in the posterior corner of the eye. In each case, careful dissections were made, using needles and working under a 48 mm. objective. No parasites of any kind were found.

In my opinion, the most significant fact of all is that all three animals were moulting, the third being in quite an advanced stage.



WENDY L. HODGES

Texas Horned Lizards (*Phrynosoma cornutum*) have a broad distribution, but have been extirpated from some core areas by urban expansion and alterations of habitat for agricultural purposes.

# A Preliminary Note on the Food Habits and Distribution of the Texas Horned Lizards<sup>6</sup>

W.M. Winton

Random examinations of stomach contents, made by various workers during the past forty years, have indicated that *Phrynosoma cornutum*, the Texas horned lizard, is of great economic importance. To determine its status as a valuable animal, an examination of four hundred and eighty-five stomachs has been made. As only a small per cent. of the animals found in the field were captured and killed, several facts — besides the principal one — concerning this animal have been disclosed.

The Texas horned lizard, unlike the other species of the genus, is distinctly not a desert form. Its area of distribution is quite extensive, going northward into Kansas, southward far into the Mexican table land, and westward into Arizona; but, clearly, the area of its greatest abundance is the north and south strip of Texas known as the Black and Grand prairies. This strip of country includes the cities of Fort Worth, Dallas, Waco, Austin and San Antonio — in fact all of the large cities of the state except Houston and Galveston; and is preeminently the best part from an agricultural standpoint. Within this area, where conditions are all favorable, the *Phrynosoma* population averages at least thirty

to the acre. This is despite the fact that for a number of years these lizards have been captured and sold to visitors from the east.

The life history has not been well worked out, but the newly hatched young begin to appear by the first of August; so that it is safe to say that the ordinary agricultural operations such as spring and fall plowing, do not interfere with the life cycle. The natural enemies are few and unimportant, being mainly road runners and opossums.

The stomachs examined included the following forms: four species of ants; four species of bees (mainly miner bees); eight species of beetles; three species of stink bugs; nymphs of grasshoppers and allied Orthoptera; five species of flies; and a few caterpillars, some of which have not yet been identified. The noxious forms found overwhelmingly outnumbered the useful forms.

<sup>6</sup> Reprinted from *Science*, New Series, Vol. 41, No. 1065 (28 May 1915, pp. 797–798).



WENDY L. HODGES

Texas Horned Lizards (*Phrynosoma cornutum*) often have been described as “ant specialists,” because of their habit of sitting near ant trails and picking off individuals that stray too close. Although consumption of small prey, if sufficiently abundant and easy to capture, can be energetically efficient, Horned Lizards opportunistically eat essentially any small arthropod that will fit in their mouths.

Agricultural ants were found in 80 per cent. and stink bugs in 60 per cent. of the stomachs. Neither of these is much subject to the attacks of birds. Obviously this enhances the value of *Phrynosoma*. Incidentally, there was a remarkable consistency or homogeneity in the contents of the individual stomachs. For example, in one case, nearly all of the forms present would be Hymenoptera; in another, nearly all would be Heteroptera, etc. This could mean that individuals acquire

a taste for sour food, or fatty food, etc.; or, what is more likely, that the same individual requires from time to time certain special elements in its food.

From the data thus far assembled, it can be safely affirmed that the horned lizards of Texas are of tremendous importance to agriculture in that region; and may, perhaps, play as important a part as does the common toad in the better watered regions of the United States.

## The Urine of the Horned Lizard<sup>7</sup>

A.O. Weese

Vauquelin,<sup>8</sup> in reporting the first analysis of reptilian urine, in 1822, stated that it was composed almost entirely of uric acid, and since that time this fact has been interpreted by various observers as an adaptation to the conditions of life in arid regions, where animals obtain their only external water supply in very limited quantities in the food substances, and this type of nitrogenous excretion involves practically no water loss. The reptiles of arid regions have been known for some time to excrete practically all of their waste nitrogen in the form of uric acid and its salts, while, on the other hand, birds and aquatic and semi-aquatic reptiles may secrete considerable amounts of urea.

The urine of the horned lizard is excreted in the dry form at the same time as the feces, from which it is separated by a constriction of the common mass, the material voided at any one time

having roughly the shape of a dumbbell, one of the enlargements being composed of urine and the other of fecal matter. The following figures for the composition of the urine of *Phrynosoma cornutum* (specimens obtained at Alamogordo, N.M.) have been obtained recently in the laboratory of physiological chemistry of the University of Illinois, the work having been undertaken at the suggestion and under the direction of Dr. H.B. Lewis.

Constituents	Mg. per Gm. of Dry Urine
Total nitrogen	260
Urea + ammonia nitrogen	1.4
Ammonia nitrogen	1.4
Uric acid	765
Creatinine	Trace
Ash	87.5
Phosphorus as P <sub>2</sub> O <sub>5</sub>	3.5

It will be noticed from the above figures that uric acid accounts for practically the total amount of nitrogen present, and that there is no urea. The small amount of ammonia is probably present as ammonium urate. The ash present is mostly composed of foreign materials (sand grains, etc.) inseparable from the urinary mass and therefore weighed and analyzed with it.

<sup>7</sup> Reprinted from *Science*, New Series, Vol. 46, No. 1195 (23 November 1917, pp. 517–518).

<sup>8</sup> Vauquelin, Louis Nicolas, "Examen des excréments des serpens que l'on fait voir en ce moment à Paris, Rue Saint-Nicaise," *Annales de Chimie et de Physique*, 2me Serie, Tome 21, p. 440, 1822. Two boas, species not stated, were the source of the urine examined in this case. Uric acid had also been associated with reptiles as early as 1793, when a "pasty deposit" found in the bladder of a tortoise by Vicq-d'Azyr was found to contain this substance [footnote from original].



SEZANNE L. COLLINS, CMNH

Like most congeners, Desert Horned Lizards (*Phrynosoma platyrhinos*) are found in arid regions that have at least some loose soil available for burrowing.