NUMBER 598 FEBRUARY 16, 1959

OCCASIONAL PAPERS OF THE MUSEUM OF ZOOLOGY

UNIVERSITY OF MICHIGAN

ANN ARBOR, MICHIGAN

# VARIATION, DISTRIBUTION, AND ECOLOGY OF THE IGUANID LIZARD *ENYALIOSAURUS CLARKI* OF MICHOACAN, MEXICO*

BY WILLIAM E. DUELLMAN AND ANN S. DUELLMAN

AMONG the reptiles and amphibians which Hans Gadow collected in México in 1908 was a series of ten iguanid lizards deposited in the collections of the British Museum (Natural History). Of these, one specimen was sent to the Museum of Comparative Zoology and was subsequently made the type of *Ctenosaura (Enyaliosaurus) clarki* by Bailey (1928). Until now, there has been no further report concerning the species. We found it locally abundant in the Tepalcatepec Valley in Michoacán, where observations were made during June and July, 1955; April, May, and August, 1956; and June, 1958. The data obtained from our preserved series, combined with the field observations, provide information concerning a species heretofore known solely as a name in checklists.

Bailey (1928) cited Gadow's original locality as "Ovopeo, 1000 feet." So far as we know there is no such place name with this spelling in Michoacán. Two similar names of places exist—Opopeo and Oropeo. Opopeo, which lies at 9000 feet in pine forests south of Pátzcuaro, is out of the range of the species. Oropeo, however, at an elevation of about 1000 feet in the lower Tepalcatepec Valley about 8 miles south of La Huacana is, in all probability, the place where Gadow secured the specimen that later became the type.[1]

## DESCRIPTION AND VARIATION

The discussion below is based on 38 preserved specimens, 15 of which are males, 17 females, and 7 juveniles. *Enyaliosaurus clarki* is a robust lizard with a known maximum snout-vent length of 154 mm. and a

* Contribution No. 4 from the Department of Biology, Wayne State University, Detroit 2, Michigan.

[1] Gadow's label was not checked, but it is possible that Bailey mistook a script "r" for a "v" and that Gadow actually wrote "Oropeo."

total length of slightly more than 300 mm. Males appear to be larger than females. Ten females with snout-vent lengths of more than 125 mm. average 135 mm., whereas eight males average 147 mm.; the smallest juvenile has a snout-vent length of 46 mm. The tail length about equals the snout-vent distance; the average tail length/snout-vent length ratio in males is 0.99; that in females 0.96.

With the exception of those of the middorsal row, dorsal scales smooth and barely imbricate, larger than laterals, and subequal in size to ventrals; middorsal row somewhat enlarged and slightly elevated to form a low crest on anterior two-thirds of body; number of dorsal scales in midline (counting from head to first caudal whorl) 76 to 110 (average 89); scales on anterior surface of shank keeled and imbricate giving a spinous appearance; supraorbital semicircles complete and separated in the midline by one scale; supraoculars small and in five rows; usually 8 upper labials (sometimes 7 or 9) and 9 lower labials (sometimes 8 or 10); loreolabials in three rows; nuchal scales granular; scales of chin and gular region flat and barely imbricate. There is a heavy gular fold which extends dorsad just posterior to the ear.

Limbs short and robust; toes moderately long and armed with heavy claws; 25 to 33 (average 28.8) subdigital lamellae beneath the fourth toe; femoral pores range from 8 to 12 (average 10.2). Although the number of femoral pores is the same for both sexes, those of females are minute and almost indistinguishable, whereas those of males are large. Proximal two-thirds of tail wide and depressed, its greatest width (about equal to that of the head) occurring at approximately one-third of its length; dorsal surface covered with whorls of large scales, separated from one another by a row of small scales; with the exception of the proximal one, whorls on basal half of tail normally composed of 9 dorsal scales, rarely 10 or 11; middorsal scale in each whorl large with a high, posterior projecting spine; adjacent scale on each side much smaller with a low keel; those more lateral increasingly larger in size and with higher keels and longer spines; the lateralmost one in each whorl with a high narrow knifelike keel; ventrally whorls less well defined with slightly keeled and imbricate scales.

Color pattern olive-brown to black dorsal ground color with light cream to tan blotches and spots (Pl. I, Fig. 1). The venter is cream, and the chin is usually streaked with dark. Unlike those of *Ctenosaura* the juveniles of *Enyaliosaurus clarki* are not bright emerald-green, but closely resemble the adults both in color and pattern. Adult males have bolder markings than females. In order to show how slight the differences in pattern between juveniles and adults of either sex are,

the following descriptions taken from preserved specimens are given.

UMMZ 112724, a juvenile with a snout-vent length of 60 mm. Dorsal ground color of head, body, and tail dark olive-brown; temporal region dark brown with a light postorbital stripe extending to the ear; labials creamish yellow and barred with black; thin lines of black across cream throat to midline of gular region; 6 transverse rows of round cream spots on body, smallest on flanks; 2 additional rows of spots on neck; forelimbs dark brown with cream flecks; hind limbs grayish brown with cream flecks; belly creamish yellow; underside of tail and hind limbs cream, the latter with black flecks.

UMMZ 112718, adult female with a snout-vent length of 130 mm. Head olive-brown; temporal region slightly darker with an indistinct light bar from eye to ear; labials and chin creamish yellow, barred with black; gular region gray; forelimbs dark brown with gray flecks; dorsum dull olive-brown with 7 indistinct tan middorsal blotches and dorsolateral spots; flanks grayish cream with faint dark brown vertical bars; dorsal surfaces of hind limbs grayish brown with irregular black markings; tail above light olive-brown; ventral surfaces of body, hind limbs, and tail cream.

UMMZ 112711, adult male with a snout-vent length of 154 mm. Top of head olive-brown flecked with cream; temporal region black with light cream bar from orbit to ear; labials dark brown with irregular cream blotches; chin cream with black lines extending from labials to dark gray throat; nuchal region brown with round cream spots; dorsal ground color black anteriorly, fading to olive-brown posteriorly; a dorsolateral row of cream spots poorly defined because of innumerable cream flecks on dorsum; 7 cream rectangular middorsal blotches becoming indistinct posteriorly; chest, anterior part of flank, axilla, and forelimb, with exception of cream palm, black; posterior part of flank with black or dark brown vertical bars separated by cream and extending onto the cream venter but not reaching the midline; anterior and dorsal surfaces of hind limb with wide black bars indistinctly separated by narrow cream interspaces; ventral and posterior surfaces of hind limb cream mottled with black; dorsal surface of tail olive-brown; ventral surface creamish yellow.

In life, the dorsal blotches of males are often orange or slightly pinkish; the pink is more common in females. The throat may be deep golden orange to yellow; the iris is grayish red.

Aside from the minor color differences noted above, there is little evidence of ontogenetic change in *Enyaliosaurus clarki*. Likewise, there are few differences between the sexes. In addition to their greater size,

males also have larger femoral pores and a more contrasting color pattern. In juveniles the head is proportionately larger than in adults; a similar difference, although not as great, is noted between the sexes in adults (Table I).

TABLE I

RELATIVE PROPORTIONS OF HEAD AND BODY IN JUVENILES AND ADULTS OF *Enyaliosaurus clarki*.

After the range the mean is given in parentheses.

| Maturity | Head Width / Snout-vent Length | Head Length / Snout-vent Length |
|---|---|---|
| Juveniles (6) | 17.6–19.5 (18.5) | 23.3–25.6 (24.0) |
| Males (15) | 15.8–19.3 (17.5) | 19.6–22.5 (21.3) |
| Females (17) | 15.1–18.4 (16.3) | 18.7–23.3 (20.4) |

## *Affinities*

*Enyaliosaurus clarki* appears to be most closely related to *E. quinquecarinatus* of Oaxaca. Both have greatly enlarged tail whorls that are composed of dorsal scales which are not uniform in size and are separated from one another by a single row of small scales; in this respect they differ from other members of the genus. The characteristics that distinguish the two species are given in Table II.

TABLE II

COMPARISON OF CERTAIN CHARACTERS OF *Enyaliosaurus clarki* AND *E. quinquecarinatus*

The ranges of variation are given first with the means (in parentheses) below.

| Species and Number | Dorsal Scales | Femoral Pores | Enlarged Dorsal Scales on 4th Caudal Whorl | Tail/Body Ratio |
|---|---|---|---|---|
| *clarki** (38) | 76–110 (89.3) | 8–12 (10.2) | 9–11 (9.2) | 0.89–1.06 (0.97) |
| *quinquecarinatus*† (34) | 65–86 (77.1) | 11–14 (13.1) | 11–13 (11.3) | 1.40–1.56 (1.47) |

* Dorsal ground color brown.
† Dorsal ground color green.

## DISTRIBUTION

*Enyaliosaurus clarki* is known at present only from the arid Tepalcatepec Valley in Michoacán, México, at elevations of 600 to 1650 feet above sea level. Since the species has been taken near the village of Tepalcatepec which is close to the border of Jalisco, it probably also occurs in that state. A resident of Ciudad Altamirano on the Río Balsas in Guerrero stated that these lizards are found in that area. Appended is a list of locality records for the known specimens. Abbreviations are: BMNH=British Museum (Natural History), MCZ=Museum of Comparative Zoology, UK=University of Kansas, UMMZ=University of Michigan Museum of Zoology.

MEXICO: *Michoacán:* 9 mi. SSW of Apitzingán, UK 29637; Arroyo de Río Cancita, 9 mi. E of Apatzingán, UMMZ 112710–17; Capirio, UMMZ 114977, 118607; 1.6 mi. N of Capirio, UMMZ 114985 (3); 2.6 mi. N of Capirio, UMMZ 112718–29; El Espinal, UMMZ 118609–10; Jazmin, UMMZ 114979; "Ovopeo" (=Oropeo), BMNH 1914.1.28.-37–39 (9), MCZ 22454; Rancho Nuevo, UMMZ 118608; Rio Jazmin, near Jazmin, UMMZ 114978 (4); 3 mi. E of Tepalcatepec, UMMZ 114976 (2); 5 mi. E of Tepalcatepec, UMMZ 114975; Zicuiran, UMMZ 114980; 2.3 mi. SE of Zicuiran, UMMZ 114981; 3.5 mi. N of Zicuiran, UMMZ 114677, 114982; 5 mi. SE of Zicuiran, UMMZ 114983; 7.8 mi. W of Zicuiran, UMMZ 114984.

## ECOLOGY

The information and discussion below result from our field studies in the Tepalcatepec Valley.

### *Physical Environment*

The valley of the Río Tepalcatepec, a major tributary of the Río Balsas, forms the western part of a large interior basin, which for the most part is surrounded by mountain ranges with elevations exceeding 6000 feet. The valley floor rises from an elevation of 500 feet at the mouth of the Río Tepalcatepec to 1500 feet west of the village of Tepalcatepec, a distance of about 80 miles. In climate, the Tepalcatepec Valley is hot and dry; the average annual temperature at Apatzingán, Michoacán, is 28.2° C., and temperatures of 43° C. have been recorded (Contreras, 1942). The winter months are exceedingly dry; 95 percent of the rain falls between June and October, and the average annual precipitation is only 714 mm.

### *Vegetation*

The Tepalcatepec Valley was divided by Leavenworth (1946) into the following sections based upon the general vegetational composition:

1. Tropical Deciduous Forest, covering the low parts of the valley floor, mostly along or near streams, where plants have access to abundant ground water.

2. Open Arid Scrub Forest, covering the greater part of the plains of the valley floor.

3. Dense Arid Scrub Forest, forming a transition belt between the open arid scrub forest and the mesic deciduous forest.

Since *Enyaliosaurus clarki* inhabits only the Open Arid Scrub Forest (Pl. I, Fig. 2), only the vegetation of that section will be described. Structurally, the forest consists of low sclerophyllous, deciduous trees that may reach heights of 10 meters but usually average about 6. Most of the trees have spreading crowns but are widely spaced and give only about 15 to 20 percent coverage. Giant cacti (in excess of 10 meters high) are scattered throughout the scrub forest; in some places they are common, in others absent. During the rainy season the trees are in full leaf, and there is a fairly continuous coverage of herbs, which is absent in the dry season. Floristically, the forest consists primarily of Leguminosae, the most common species being *Acacia* sp., *Albizzia* sp., *Apoplanesia paniculata, Cercidium plurifoliolatum, Lysiloma tergermina,* and *Prosopis* sp. Also present are *Bursera confusa* (Burseraceae) and *Crescentia alata* (Bignoniaceae). The giant cacti are *Acanthocereus pentagonus* and *Pachycereus pecten-aboriginum.* The carpet of grass in the wet season is chiefly composed of *Opiza stolonifera.* A low, broad-leaf herb, *Trianthema portulacastrum* (Aizoaceae), is also abundant.

### *Habits and Behavior*

Essentially, *Enyaliosaurus clarki* is a tree dweller, living mainly on *Aploplanesia paniculata.* The lizards usually make their homes in the hollow trunks or branches of this tree, but sometimes live in hollow logs, stumps, cacti, or fence posts. The few individuals seen on the ground were in rocky areas and took refuge beneath large boulders. The lizards are often seen sunning on branches from 1 to 3 meters above the ground. When one is disturbed it retreats head first into a hollow trunk or branch and blocks the cavity from behind by arching its tail. The basal portion of the tail is pressed against that part of the hollow by the lizard's back, and the distal portion is pressed against the opposite wall (Fig. 1). The strong tail muscles hold it in place, and the sharp caudal spines present a formidable defense against a would-be intruder. The tip of the tail, which is covered with small scales that lack spines, is missing in about two-thirds of the specimens. This indicates that the use of the tail in this manner serves to protect the lizard against predators. Regenerated portions of tail do not have whorls of large spines, but are covered with homogeneous small scales.

Evidently, individuals change their hiding places as they grow larger, since all were found to fit their particular hollow so that the tail effect-

ively closed the cavity. Juveniles showed the same behavior in small cavities. An individual removed from one tree and placed in another with larger hollows will take refuge in one of them. But from such a situation a lizard is easily removed, because its efforts to block its retreat are ineffectual. When placed in a tree with a small cavity a lizard will attempt to enter it, but, if unsuccessful, it will seek another or jump to the ground and scamper to another tree. To obtain living specimens of *Enyaliosaurus clarki* from their retreats required time and effort. Usually part of a branch was cut away with a machete and pried open or split with a crowbar, before the lizard could be grasped by a hind leg and pulled from the cavity.

In trees these lizards employ a quiet, deliberate form of locomotion. They are rarely seen far from their retreats, and when approached they

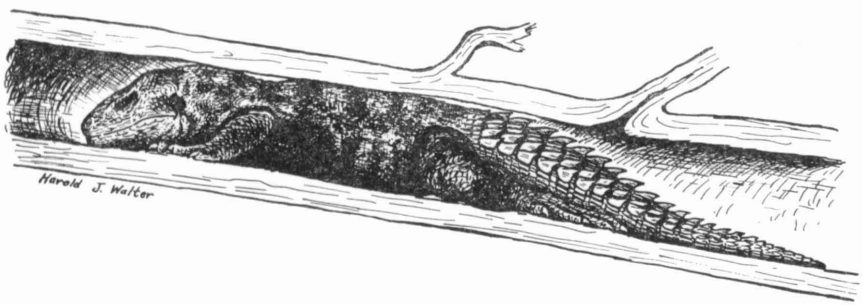


FIG. 1. Section of a hollow branch showing *Enyaliosaurus clarki* in its customary retreat.

slip quietly into their holes; the only noise to attract the collector's attention is the scratching of claws within the cavity. In comparison with other large iguanids, such as *Ctenosaura,* these lizards move relatively slowly on the ground and seem to depend more on awareness of approaching danger than on agility. On the ground they run with the body elevated but with the heavy tail dragging behind.

Although two or more individuals were sometimes found in the same tree, no two were observed to occupy the same hole. They are solitary, not gregarious like *Ctenosaura pectinata,* large colonies of which often live in rock fences or in large dead trees. *Enyaliosaurus clarki* was not seen to assume any defensive posture such as is characteristic of many lizards. When caught, few attempted to bite, but those that did held on with great tenacity. Usually, the tail was strongly, though slowly, gyrated, unlike *Ctenosaura* which lashes its tail.

The absence of specimens of *Enyaliosaurus clarki* from collections that have been made in the Tepalcatepec Valley for the past fifty years may be the result of the wariness and inconspicuous nature of the species. Furthermore, at a distance these lizards may be confused with the more common *Ctenosaura pectinata.* We found *Enyaliosaurus* to be locally abundant in the valley; large numbers were observed near Capirio, El Espinal, and Jazmin. At Jazmin more than thirty were seen during a two-hour period in April, 1956. In the vicinity of Capirio and Jazmin *Enyaliosaurus* was active throughout the day both in wet and dry seasons. Although temperatures in the lower Tepalcatepec Valley may reach 43° C. during midday, many of these lizards were seen in the trees at a time when such abundant terrestrial forms as *Cnemidophorus sacki* and *Sceloporous pyrocephalus* were active. Individuals observed on the ground were always seen in the morning, an indication that their feeding and greatest amount of activity probably takes place then. Shortly before dusk they were commonly found in their retreats in the hollow branches.

The areas inhabited by *Enyaliosaurus clarki* have a herpetofauna characteristic of the lower arid tropical region, and several species of diurnal lizards are present—*Anolis nebulosus, Cnemidophorus calidipes, Cnemidophorus deppei lineatissimus, Cnemidophorus sacki copei, Ctenosaura pectinata, Sceloporus horridus oligoporus, Sceloporus pyrocephalus,* and *Urosaurus gadowi.* With some of these lizards *Enyaliosaurus* probably competes for food. *Ctenosaura pectinata* is an herbivorous species that occurs closely associated with *Enyaliosaurus;* small individuals were found occupying holes in *Apoplanesia,* the usual retreat of *Enyaliosaurus.* Presence of ants in the diet of young of *Enyaliosaurus* suggests that the juveniles compete with some of the smaller lizards, especially *Urosaurus.* Two common diurnal snakes in the area, *Masticophis striolatus* and *Salvadora mexicana,* often feed on lizards. Although *Cnemidophorus, Sceloporus,* and small individuals of *Ctenosaura* have been found in their stomachs, *Enyaliosaurus* has not. Its spiny tail may be discouraging to would-be ophidian predators, but nonetheless, some predator is responsible for the frequently missing tail tips.

### *Food Habits*

Stomach contents of specimens collected in the dry and wet seasons reveal a predominance of vegetable matter, mostly leaves, probably from the small trees upon which the lizard lives. Other identifiable remains were grasshoppers in adults and ants in juveniles.

### *Growth*

No observations were made on breeding habits, time of breeding, or egg laying. It was possible, however, to arrive at certain tentative conclusions concerning these phenomena from an examination of the available specimens. A series of six small juveniles with prominent umbilical scars and an average snout-vent length of 57 mm. was collected in late June, 1955. The smallest juvenile, having a snout-vent length of 46 mm. and an open umbilicus, was collected June 22, 1958. Collections made in April contained no juveniles. From this it seems that the young hatch in early or middle June. Females collected in April did not contain eggs. Evans (1951: 10) reported *Ctenosaura pectinata* depositing eggs near Cuernavaca, Morelos, on April 11; the eggs of *Enyaliosaurus* may be laid about the same time.

The rate of growth is difficult to determine from the specimens at hand. When the body lengths are plotted, three groups are apparent (Fig. 2). The first of these (45–70 mm.) comprises recent hatchlings; the second (80–130 mm.) presumably represents yearlings; the last (135–155 mm.) includes individuals two or more years in age.

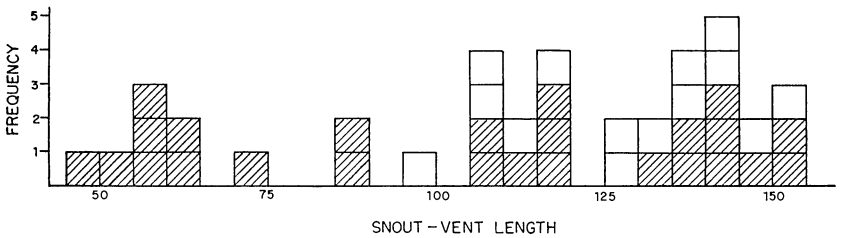


FIG. 2. Histogram showing size groups of *Enyaliosaurus clarki*. Crosshatched blocks represent specimens collected in the summer (late June to mid-August).

## FOLKLORE

The natives of the Tepalcatepec Valley call *Enyaliosaurus clarki* "nopiche." They fear this lizard and consider it to be venomous, even more venomous that the "escorpion" *(Heloderma horridum)*. We were told that these lizards are extremely poisonous and that they come down from the trees at night and prowl around biting people and animals. The residents are particularly concerned for their cattle, which seemingly bear the brunt of the nopiche attacks. It is said that the lizard drops from a tree and lands on the back of the unsuspecting bovine. On one occasion we were shown the result of a nopiche bite on a cow. On her neck was a freely bleeding razor-like cut, evidently the work of a vampire bat *(Desmodus rotundus murinus)* during the previous night.

If all vampire bites are credited to the nopiche, it is easy to understand the natives' superstitious fears of these lizards. We have been unable to find any evidence to support the idea that the lizards are dangerous to man. Lizards of bizarre form, or with bright colors, are often considered to be poisonous. Here the spiny tail of *Enyaliosaurus clarki* may be the basis for such beliefs concerning these lizards.

ACKNOWLEDGMENTS

We are grateful to Richard E. Etheridge, Fred G. Thompson, Jerome B. Tulecke, and John Wellman for their assistance in collecting specimens and making field notes. We wish to thank J. C. Battersby for information concerning specimens in the British Museum (Natural History), John M. Legler for the loan of a specimen from the University of Kansas Museum of Natural History, Arthur Loveridge for permission to examine the type of *Enyaliosaurus clarki,* Rogers McVaugh for identifying certain plants, Roger and Isabelle Hunt Conant for the photograph of a living specimen, and Harold J. Walter for the drawing (Fig. 1). Field work in México in 1955 was supported in part by a grant from the Horace H. Rackham School of Graduate Studies, and in part by the Museum of Zoology of the University of Michigan; that in 1956 in part by a grant from the Penrose Fund of the American Philosophical Society and in part by the Museum of Zoology; that in 1958 by a grant from the Graduate School of Wayne State University.

LITERATURE CITED

BAILEY, JOHN W.
1928 A Revision of the Lizards of the Genus *Ctenosaura.* Proc. U. S. Nat. Mus., 73 (12): 1–58, Pls. 1–30.

CONTRERAS A., ALFONSO
1942 Mapa de las provincias climatologicas de la Republica Méxicana. Dir. Geog., Metero., Hidro., Insto. Geog. México, D.F., pp. i-xxvii, 2 maps.

EVANS, LLEWELLYN T.
1951 Field Study of the Social Behavior of the Black Lizard, *Ctenosaura pectinata.* Amer. Mus. Novitates, 1493: 1–26, Figs. 1–8.

LEAVENWORTH, WILLIAM C.
1946 A Preliminary Study of the Vegetation of the Region between Cerro Tancitaro and the Rio Tepalcatepec, Michoacan, Mexico. Amer. Midl. Nat., 36 (1): 137–206, Figs. 1–20. 1 map.

*Accepted for publication August 21, 1958*

PLATE I

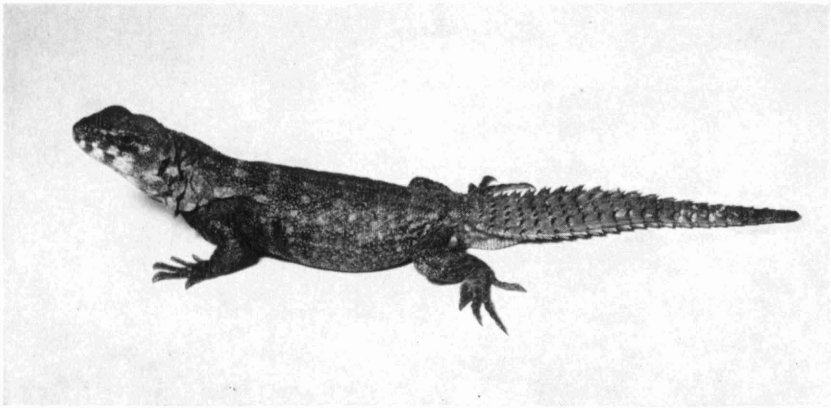

FIG. 1. Adult male *Enyaliosaurus clarki* from near Zicuiran, Michoacán.

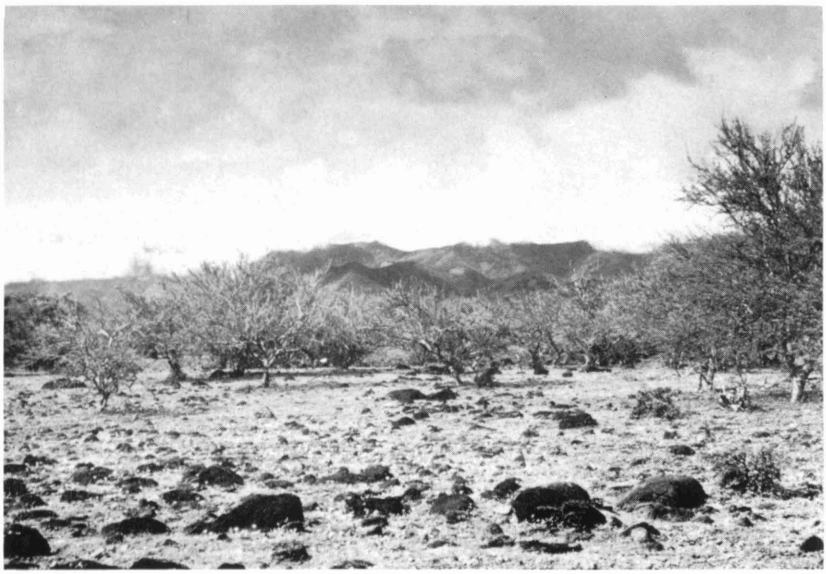

FIG. 2. Habitat of *Enyaliosaurus clarki*, 2.6 miles north of Capirio, Michoacán. The trees are *Apoplanesia paniculata*, *Cercidium pluriofoliolatum*, and *Prosopis* sp.; the grass in the foreground is *Opiza stolonifera*.