MISCELLANEOUS PUBLICATIONS
MUSEUM OF ZOOLOGY, UNIVERSITY OF MICHIGAN, NO. 128

Reptiles of Rancho Grande and Vicinity, Estado Aragua, Venezuela

BY

FREDERICK H. TEST
University of Michigan

OWEN J. SEXTON
Department of Zoology
Washington University, St. Louis

AND

HAROLD HEATWOLE
Department of Biology
University of Puerto Rico

ANN ARBOR
MUSEUM OF ZOOLOGY, UNIVERSITY OF MICHIGAN
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REPTILES OF RANCHO GRANDE AND VICINITY, ESTADO ARAGUA, VENEZUELA

THREE periods of study at the Estación Biológica Henri Pittier (Rancho Grande) have allowed the accumulation of considerable information on the reptiles of the region. This work has spanned the year, distributed as follows: Test, September 22, 1951–January 20, 1952; Test, Sexton, and Heatwole, June 21–September 2, 1956; Test, January 12–June 18, 1960. In all of these periods the collecting of reptilian specimens and information about them was incidental to other studies, mostly ecological, with particular reference to amphibians.

Beebe spent three periods at this place in the 1940's and has referred to some of its reptiles in his book, High Jungle (1949). Several Venezuelans have collected there, and some of these records have been published by Roze (1952–1964) in his fine contributions to Venezuelan herpetology. There is no published list, however, of the reptiles of the Rancho Grande area. Because of the opportunities for much additional study in this region of such great biological diversity and interest, we hope this paper may provide a basis for future work. Even in the ferreting out of the species that occur there, probably much is to be done.

Our headquarters were at Rancho Grande, the Estación Biológica Henri Pittier, in the mountains above Lake Valencia and the city of Maracay, Aragua. The rich Aragua Valley, with Lake Valencia near its center at an elevation of about 425 m., is largely agricultural land. The bowl-shaped valley is surrounded by mountains of the Caribbean Range (Cordillera de la Costa) of the Andes (Liddle, 1946), which extend eastward for about 250 km. along the coast. Westward they are separated from the northeast fork of the main axis of the Andes by the broad valleys of the Yaracuy and Barquisimeto rivers at about 400 m. altitude.

Rancho Grande lies in the coastal (northern) part of the divided Caribbean Range, on the southern slope within 200 m. of a narrow pass, Portachuelo. The elevation of both is close to 1100 m. Eastward, elevations rise to 1900 m. (Pico Guacamayo) close above Rancho Grande and to 2400 m. a little farther east. On the west side of Portachuelo Pass is Pico Periquito, 1500 m. The coastal range for about 40 km. eastward from Turiamo Bay (on the coast northwest of Rancho Grande) is protected by inclusion in the Henri Pittier National Park, is almost uninhabited, and is largely covered in its upper reaches by cloud forest (Montane Rain Forest; Beard, 1944) showing almost no disturbance by man. Here environmental conditions are rather uniform throughout each diel period and throughout the year, with

continuously low light intensities in the evergreen forest, high moisture content in soil and air, and little fluctuation in temperature. At the level of Rancho Grande, temperatures in the primary forest were usually 16–20° C. The rainy season usually began in April, reached its greatest rainfall in June, July, and August, and decreased into December. January, February, and March had only traces of rain, if any. Even in the non-rainy season the forest usually was continuously wet because of the fog which was present for most of the time except from 7 to 10 A.M. It was much less prevalent in the rainy season.

The steep slopes are mostly covered by thin layers of litter and humus. Many small depressions contain thicker layers of these materials, while in some places the inorganic soil is exposed. At Rancho Grande the underlying rock is largely reddish and yellowish quartzose muscovite schists (identification by E. William Heinrich) which have broken down to form a clay soil of the same colors. Rock is exposed in few places, mostly road cuts. (At Choroní Pass to the east much of the soil beneath the usually thin litter is composed of coarse granitic particles, thus being extremely porous.) The forest trees are mostly lower than 20 m. and are more or less thickly covered with epiphytes, from small hepatics to large ferns, orchids, and bromeliads. Where the latter occur in crotches or on large horizontal limbs they collect large quantities of litter and humus. The ground vegetation includes a large proportion of ferns, and is not dense except where fallen trees have let in more light. Understory vegetation likewise is not dense; it has numerous small palms, cyclantaceans, melostomes, heliconias, and young trees. Some tree trunks are covered with climbing ferns and cyclantaceans. On the ground, logs are uncommon, but the large, dense, fallen leaves of the stilt palm (*Iriartea*) provide shelter for many small animals. The interior of the forest is shown in Plate I.

Below the cloud forest is a zone of partly deciduous forest (Semi-evergreen Forest) in which the tree canopies are abundantly draped with leafy vines and which is rather dry in the non-rainy season because fog seldom descends to it. Still lower is forest almost completely deciduous (Deciduous Seasonal Forest), burned off in many places, and replaced by tall, dense grass. Gallery forest, which probably represents the remnant of the original forest, persists along the streams. A coastal strip has low scrub forest of small-leaved trees and contains abundant cacti and xerophytic terrestrial bromeliads. The valley of the Río Periquito, flowing northward from the Rancho Grande region, is cultivated with cacao and rubber in its lower reaches and flows by the town of Ocumare de la Costa near the coast.

At Rancho Grande itself is a mixture of habitats. The building lies near and within the lower limit of cloud forest on the south side of the

divide, although cloud forest extends considerably lower in the deeper ravines. Thus, the dryer, warmer zone next below is not far away. The paved road has opened a swathe to the sun and provided a drier warmer strip through the cloud forest. Shoulders and cuts along the road have their vegetation trimmed several times a year for a distance of 3–5 m. from the pavement. The Station building is a large concrete edifice, begun thirty years ago as a hotel and partly completed for use as a biological station. Nearly half of it remains unfinished; the rooms are without doors or windows. Some have growths of algae and moss, and most contain puddles of water in the rainy season. A tiny stream tumbling down the steep mountainside close behind the building is carried beneath the central part by a drain. Small lawns, a picnic area, and decorative plantings extend along the front. Back of the building there reaches upslope for perhaps 150 m. a partly terraced semicircle of secondary forest in which heliconias and planted *Casuarina* are prominent.

Below the building is an area with four houses, all but one now unoccupied, and several hectares of modified forest and grassy areas in which are abandoned plantings of banana, citrus, and coffee, and where several cattle were grazed a number of years before.

It should be evident that the immediate vicinity of Rancho Grande is an ecological mosaic, with considerably greater, and less regular, variation than that so characteristic of mountainous areas. Because of this, records of animals there should be carefully pinpointed in location to be of much distributional or other ecological use. With great differences occurring within a few meters, the designation "Rancho Grande" alone is insufficient for precise work and may actually be misleading, for a reader might suppose any Rancho Grande records to represent cloud forest.

The reader is referred to papers by Beebe and Crane (1947), Schäfer and Phelps (1954), and Heatwole (1961) for more detailed information on the ecological conditions, including zonation, in the region around Rancho Grande, from the Aragua Valley to the coast, and to the first two papers for maps.

Our work, centered on other problems, was concentrated in the cloud forest around Rancho Grande, with only rare trips to the coast and the Aragua Valley for study. Of necessity we moved about the Station grounds and along the road nearby nearly every day, sometimes through parts of the secondary forest in reaching particular places in the cloud forest; a trip by automobile was made to Maracay once or twice a week in 1956 and 1960 (less frequently in 1951–52). No comprehensive studies, or even planned samplings, were made in any environment but the cloud forest except for a small part of Heatwole's work in 1956. Our studies in the cloud forest were

not directed primarily to reptiles. Sexton, in 1956, did direct some spare-time activity to snakes. Thus, our coverage of various environments and localities in the region from which we have specimens was extremely variable and inadequate as a survey. Other species than those included here will almost certainly be found in future work, and much more study will be necessary to show even the distributional aspects of their ecology adequately.

In the following accounts all measurements are lengths from snout to anus unless indicated otherwise. All localities for records of animals, unless otherwise shown, are in the state of Aragua.

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In the three periods of residence in Venezuela we have been helped in many ways, with typical Venezuelan generosity, by many persons, especially Leandro Aristeguieta, Walter Arp, Alejandro Dominguez, Alonso Gamero, Ricardo Gondelles, Tobias Lasser, Herman Martinez, Alicia Martuzzi, Cecilia Martuzzi, Vincente Martuzzi, Gonzalo Medina, Edgardo Mondolfi, Juhani Ojasti, Janis Roze, Ernst Schäfer, Miguel Schön, José V. Scorza, Francisco Tamayo, Baldur Terzenbach, Willy Tille, Pedro Trebbau, and Franz and Barbara Weibezahn. Assistance in the field was frequently provided by Pablo Carmone, José Garcia, and José Perez. From Cesar Aleman, Janis Roze, Ernest E. Williams, T. M. Uzzell, Jr., Norman E. Hartweg, and Charles F. Walker we have received assistance in identification, and we are indebted to the latter two, also, for providing access to the collection of the Reptile Division of The University of Michigan Museum of Zoology. Janis Roze and Charles Walker have offered suggestions on the manuscript. Avery R. Test aided the field work in a great many ways. John Tottenham drew the text figures. The use of the Biological Station was kindly provided through the Venezuelan Ministry of Agriculture and Husbandry. The 1951–52 trip was supported in part by the Horace H. Rackham School of Graduate Studies of The University of Michigan (Project 855), that in 1956 by the National Science Foundation of the United States (Grant G2244), and the work in 1960 by the School of Biology of the Central University of Venezuela. To all of these we offer our sincere and hearty thanks.

SPECIES ACCOUNTS

Order Testudinata

Family Chelydridae

Kinosternon scorpioides (Linnaeus).—On August 19, 1956, seven turtles were collected between Ocumare de la Costa and Puerto Ocumare (which is at the beach), from a ditch, 20 cm. deep and 1 m. wide, which passed beneath the road to Cata. This is in the drainage system of the Río Ocumare at an

elevation of 25 m. It connected two shallow ponds filled with vegetation, especially reeds. These ponds probably did not contain water through the dry season.

One turtle was on a stone culvert about 25 cm. above the water, in light shade. The other six were captured in traps baited with fish and set in the water. Four of the seven were preserved (UMMZ 124291–4) and the other three kept in captivity. Sexton (1960) has reported on these captives, especially on their reproductive behavior.

Order Squamata

Family Gekkonidae

Thecadactylus rapicauda (Houttuyn).—The only individual collected was from a fence row in a cattle pasture on low ground near Ocumare de la Costa, August 19, 1956.

Family Sphaerodactylidae

Gonatodes taniae Roze.—The species of *Gonatodes* at Rancho Grande was recently described by J. A. Roze (1963). Individuals are larger than in most species of this genus.

This gecko was commonly associated with buildings and creviced rock faces in road cuts in the cloud forest zone, where our observations were made. Most were captured at elevations of 1050–1096 m., but Harold Heatwole and Frank Torres took an adult male asleep on a large wet boulder near the stream which crosses the road at a place called Los Riitos (775 m.) on the coastal side of the mountains, below Portachuelo Pass, July 22, 1961. Exclusive of buildings, individuals were seen most commonly on a high retaining wall, which had numerous openings for seepage, immediately below the Station building.

A captive female, 4.9 cm. long, deposited a single egg on July 21, 1956. It was 1.0 × 0.9 cm., brittle, and yellowish ivory. She laid it in damp sand beneath the ledge of a small rock, then heaped sand over it to a depth of 1 cm. Deposition was completed at 8:45 A.M., and she remained with the egg until 11:30 A.M. Hatching had not occurred by September 3. A female, captured November 29, 1951, held an ovum approximately 5 × 3.5 mm.

Our evidence indicates that although the greatest number of young are recruited to the population in the rainy season they may be hatched at any time of year. Table 1 provides this evidence. Because of their size, coloration, behavior, capture away from shelter, and evident umbilicus, the young of 22–24 mm. listed in the table probably were hatched within a few days preceding capture. The probable dates on which they were deposited as eggs have been judged from estimated growth rates. On the basis of our data for *Proctoporus achlyens,* which, as an adult, is about the same size as or a

TABLE 1

EVIDENCE ON BREEDING SEASON OF *Gonatodes taniae* AT RANCHO GRANDE

Month	Snout-anus length (mm.) of small lizards collected or handled alive		Indicated Months	
	Recently hatched	Older	of egg deposition	of hatching
Jan.			X	
Feb.			X	X
Mar.	23.7 (Mar. 11)		X	X
Apr.			X	X
May	23.5 (May 1)	25.3 (May 5)	X	X
June	22.8 (June 3) 22.9 (June 29)	27.5 (June 6)	X	X
July	24.4 (July 13) 22.6 (July 23) "hatchling" (July 24)	26.7 (July 23)	X*	X
Aug.	22.7 (Aug. 13)	27.7 (Aug. 1)	X	X
Sept.	"3 very small" young, (Sept. 23–Oct. 3)			X
Oct.	(see Sept., above)			X
Nov.				
Dec.			X**	

* Egg deposited by captive July 21.
** Female captured November 29, with large ovum.

little smaller in body bulk than this *Gonatodes,* we assume an incubation period of about two months and early growth of 4–6 mm. per month. Because this *Gonatodes* inhabits less shaded places than *Proctoporus achlyens,* it may develop a little more rapidly, but this would depend on conditions at the exact spot where eggs are deposited. Most of the small young were found on the floors of the Station building, both inside and on the open balconies.

The largest individual measured was a male of 5.2 cm. The tail of recently hatched young was orange ventrally and contrastingly barred with black dorsally. The tip was commonly held vertical and waved slowly; this may be protective against some predators.

On March 10, 1960, at 10:45 A.M., an adult *Gonatodes taniae* with intact tail was seen chasing another with only a stub of a tail. The latter kept mostly under the curled fallen leaves as it moved in spurts below a steep bank alongside the highway at Rancho Grande. The pursuer soon came up onto the elevated edge of the concrete road and moved along it a few

centimeters. Suddenly it stopped and looked briefly and intently down toward the leaves, then continued slowly and stealthily along the edge for 20 cm. and jumped down onto the other one. The attacked individual ran about 1.5 m. before stopping, while the aggressor turned and went back in the direction it had come. This is suggestive of territorial behavior, which is also indicated by the presence of only one large gecko in each drainage hole of the retaining wall mentioned above.

All our records for this species are for daylight, though our observations indicate it may not be active in sunlight in the hot part of the day. Examination of the wall below the building several times at night showed no geckos. An adult found in mid-afternoon of February 18, lying on the road near Portachuelo Pass, may have been absorbing heat from the road. Though apparently uninjured, it did not retreat until approached closely. Two large individuals were found smashed on the road in 1960, one in the middle of February and one in early May.

Gonatodes vittatus vittatus (Lichtenstein).—These lizards were common on Zorro Island in eastern Lake Valencia where they inhabited the walls of a stone house and the crevices between boulders. Both of these situations were shaded by vegetation, but flecks of sunlight penetrated to the ground. As the vegetation here was deciduous, the sunlight would be much stronger in the dry season. The island, at an elevation of 427 m., was about 800 m. from the nearest shore. Three specimens were collected July 25, 1956.

A single specimen was taken August 4 in the recently cut litter of a cacao plantation near the junction of the Comboto and Periquito rivers, only slightly above sea level.

Pseudogonatodes lunulatus (Roux).—We obtained two specimens which largely fit Roux' description (1927) of *Lepidoblepharis lunulatus,* which was based on a single individual. When more material is available, study may show that *lunulatus* and *guianensis* (Parker, 1935) are conspecific or that the few differences apparent in available specimens (Parker's description was based on two females) are indicative of three different taxa.

One (UMMZ 124312) of our two specimens was obtained at about sea level, near Ocumare de la Costa, the other (UMMZ 124313) in cloud forest at Rancho Grande. Another (UMMZ 56516) from 364 m. in the mountains of the Andean state of Táchira, has also been available. For comparison, we had Ruthven's type and mutilated paratype of *P. furvus,* as well as two specimens of *P. barbouri* (Noble). All of these have the digital scalation shown by Parker (1926) for *Pseudogonatodes,* which genus we believe worthy of recognition. On the basis of his description, Roux' *Lepidoblepharis lunulatus* has this same pattern of toe scales, as pointed out by Parker (1935). It is not, however, conspecific with *P. furvus,* as he suggested it might be.

The Rancho Grande specimens, one a gravid female, are much smaller than *furvus*. They also differ in having four rather than five upper labials, less nipple-like dorsal scales, and ventral scales with the posterior edges more broadly rounded on the average. In addition, the posterior end of the first lower labial differs in being narrower than the part of the scale in front of it and in abutting only on the second labial behind it. In *furvus* the posterior end of the first labial is not narrowed, and it abuts on two fairly large scales of about equal size behind it.

P. barbouri is similar in size to our Venezuelan specimens but has the dorsal scales, as exemplified by those immediately anterior to the pectoral region, flat and imbricate. The exposed edges of the belly scales are also more broadly and evenly rounded than in the Venezuelan animals. In Table 2, the three Venezuelan specimens are compared with each other and with the original descriptions of *Lepidoblepharis* (= *Pseudogonatodes*) *lunulatus* and *P. guianensis* in features in which they differ. Our two animals from the vicinity of Rancho Grande differ appreciably from one another in four features: toe proportions, size of postrostral scales, form of dorsal scales, and dorsolateral markings. There is the possibility that they represent two geographic races, as they were taken 1000 m. apart in altitude, but this seems unlikely. It is more probable that their differences represent individual and sexual variation.

The Táchira specimen (UMMZ 56516), which appears to have dried somewhat before preservation, is like one or the other or both of our specimens from the Cordillera de la Costa except in two ways. It has one or two more longitudinal rows of belly scales, and its head is narrower. The latter characteristic may be a result of the poor preservation. It is judged to belong to the same species as our specimens from the Rancho Grande area.

Comparison with Roux' description of *lunulatus* shows only three clear differences: in ratio of orbital diameter to distance from ear to eye, in relative lengths of fingers, and in color pattern on the ventral side of the tail. The first difference may be artificial, resulting from variation in method of measuring. The second is of a kind often useful in differentiating between species of lizards, but the difference in this respect between our two specimens from the Rancho Grande region throws doubt on its usefulness here. The difference in tail coloration may easily be individual. On the basis of the morphologic evidence, as well as geographic indications, we tentatively refer all three of the Venezuelan specimens at hand to *Pseudogonatodes lunulatus* (Roux).

Parker's description of *P. guianensis* indicates five or less differences from the specimens we consider to be *lunulatus*, but they are all relatively minor. One, in fact, may be non-existent, for it is not clear from Parker's

description whether he is calling one of the enlarged postrostral scales a nasal or whether a third nasal lies between the nostril and the nearest large postrostral. If the former, *guianensis* would resemble *lunulatus* in perinasal scalation. The coloration of the dorsal base of the tail in *guianensis* could easily represent individual variation or a faded pattern.

It is not unlikely that adequate series of specimens from various geographic regions of northern South America will show *lunulatus* and *guianensis* to be conspecific.

Family Iguanidae

Anolis tigrinus Peters.—Our first specimen was caught August 6, 1956, as it walked along the parapet of the second floor in the unfinished part of the Station building. As it was the only one we saw, we thought it might have come from the warmer, dryer zone below the cloud forest (in which we did little work) and have found suitable conditions in the Rancho Grande clearing. However, on June 6, 1960, another was found flattened on the highway about 0.5 km. from Portachuelo Pass, where the road runs through cloud forest on the north side of the divide. Our best guess now is that this species may inhabit the upper levels of large trees, perhaps among epiphytic vegetation.

The living animal was light brownish gray, with mossy green mottling on the back when captured. Placed in a jar for a short time it lost the green and became slightly paler, with four short, transverse black bars across the back between head and hind limbs. Its sides were thickly covered, leopard-like, with small black spots and a few pale yellow ones; the throat fan was pale gray spotted with black.

We are grateful to Ernest Williams for identifying our specimens.

Anolis nitens (Wagler).—This species was never found near Rancho Grande nor in the cloud forest. All our specimens and records are from warmer, more open areas with trees, at lower elevations. One specimen (UMMZ 124297) came from the roadside in deciduous forest at 525 m. on the coastal side. Three were taken on recently cut litter in a cacao plantation, one along a fencerow through a pasture, and another on cut brush beside a trail in semiopen country along the Río Periquito near La Trilla. All these were at elevations of 150 m. or less on the road to Ocumare de la Costa. One individual was collected while asleep at night about 60 cm. above the ground on a branchlet of a bush, at the road pass above Turiamo, alt. 355 m. Several others were seen, January 6, on the slopes above the west side of the pass, moving about in the daytime. As the deciduous trees had lost their leaves, it is possible that the noise made by the lizards in the dry leaf litter directed our attention to them. In contrast, none was seen on Novem-

TABLE 2

COMPARISON OF THREE VENEZUELAN SPECIMENS OF *Pseudogonatodes lunulatus* WITH ORIGINAL DESCRIPTIONS OF THAT SPECIES AND *P. guianensis*

Characteristics	UMMZ 124312	UMMZ 124313	UMMZ 56516	*lunulatus*	*guianensis*
Sample size; sex	1 female (gravid)	1 male	1 female?	1 female?	2 females (1 gravid)
Snout-anus (mm)	27.5	28.1	28.4	20	30 27
Snout-anus/head length	5.1	4.6	4.7	4.5	5.0 4.9
Head width at ear (mm)	4.2	4.8	3.8	?	4.0 3.5
Orbital diam/ear–eye	> 0.5	> 0.5	> 0.5	0.5	> 0.5
Relative lengths of fingers	$3 > 4 > 2$ 3 & 4 nearly equal; 4 distinctly longer than 2	$3 > 4 > 2$ 3 & 4 nearly equal; 4 distinctly longer than 2	$3 > 4 > 2$ 3 & 4 nearly equal; 4 distinctly longer than 2	$3 > 4 = 2$	?
Toe proportions	$3 > 4$	$4 > 3$	$3 > 4$	$4 > 3$	?
Enlarged postrostral scales	3; equal	3; median, one-half diam. of laterals	3; median, one-half diam. of laterals	3; equal	4
Dorsal scales immediately anterior to pectoral region	semi-flattened	nipple-like with slight flattening	nipple-like with slight flattening	"small, granular"	"subconical granules"
Longitudinal rows of scales at midbelly	20–21	20–21	22–23	?	"about 22"
Dorsolateral brown band	continuous to pelvis; no spots	left side breaks up into spots posteriorly; right side with spots for entire length	no pattern (faded?)	breaks up into spots posteriorly	dorsum with faint darker and lighter spots

TABLE 2 (Continued)

Characteristics	UMMZ 124312	UMMZ 124313	UMMZ 56516	*lunulatus*	*guianensis*
Dorsal side of tail	on each side a dorsolateral light stripe from sacral region along tail to middle where they unite to cover upper surface; separated on base of tail by irregular, noded, medium dark area	Similar to UMMZ 124312	no pattern (faded?)	brown above without distinct pattern	a distinct light dorsolateral line from sacrum onto base of tail
Ventral side of tail	median series of light spots	no spots; a poorly defined light streak	no pattern (faded?)	without distinct pattern	median series of light spots
Lips	dark, with light areas	dark, with light areas	dark, with light areas	dark, with light areas	light, spotted with dark
Top of head	light back to eyes; area between eyes dark	light back to eyes; area between eyes dark	no pattern (faded?)	paler than interorbital regian	light; narrow light bar connecting anterior halves of upper eyelids and a median bar extending posteriorly from it

ber 9, at the same place, even with more people in the group. The foliage at this time reduced the light intensity beneath the trees, and the moist litter made no sound as animals moved over it.

All individuals seen were on the ground or within a few centimeters of it. One captured in the Botanical Gardens in Caracas ran about 1 m. up a tree trunk before capture.

One kept a short time in a large culture dish with a young individual of *Anolis squamatulus* was consistently brown, whereas the latter was always green in the same circumstances. It attacked and thoroughly cowed the young *squamatulus*, which was somewhat smaller. Those seen in the field were brown. Some of our specimens are striped, and some have only dorsal chevrons. As we saw no evidence of individual change, these differences in pattern are probably genetic, intraspecific variation (see Shreve, 1947). The bright color in the throat fan was red.

Anolis squamatulus Peters.—This large anole was found only in the cloud forest, where the difficulty of seeing it suggests it is more common than our records indicate.

It was found on low plants and trees. One was hanging head downward on the end of a leafy branch of a young tree at a height of 1.5 m. It was noticed only when approximately 30 cm. from the face of one of the writers as the branch was about to be brushed aside. Two other members of the party had already passed this spot. It remained motionless until seized, when it struggled violently and attempted to bite. A second individual was taken on one of the small, palm-like species of Cyclantaceae about 1.3 m. above the ground. Another was 2 m. from the ground on the horizontal midrib of a small tree fern. When disturbed, it jumped to the ground and ran 1.2 m. up a small, nearby sapling. Another attempt to capture it was unsuccessful, and it ran up to 7 m. where it clung motionless to the trunk. After about 30 min., in the course of which it shifted to head-down position, it came slowly down the trunk headfirst and was captured.

A 12-cm. individual was marked and released on October 26, a week after capture, on the fern where it was originally found. Two days later it was on the broad leaf of a species of *Heliconia,* 1.5 m. from the ground and only 3 m. from that fern. On November 26 it was again on the same *Heliconia* leaf, suggesting a restricted activity range as is known for some other species of *Anolis*. Both times it permitted approach to less than a meter, where the identifying marks were readily seen.

Two were observed at night, apparently sleeping—one on a broad araceous leaf about 1 m. above the ground and the other, head up, 60 cm. from the forest floor, on a vertical, hanging leaf of a young tree. Both re-

mained motionless until touched, even though one had been photographed by a flash camera.

All of the records above, as well as the behavior of the lizard chased up the tree, indicate that this species is probably restricted to the lowest layer of large-leaved vegetation in the cloud forest. Despite its dependence on remaining motionless for protection, it is quick and agile, for its size, in running and jumping. In addition to its natural backgrounds, the low light intensity of the cloud forest is doubtless useful also in aiding escape from predators which hunt by sight.

A defecated pellet from the marked lizard was composed of chitin from good-sized black beetles. A young lizard caught de-winged flies in captivity by turning in their direction, then leaning toward them, and finally making a short rush. When caught, a large fly was shaken vigorously several times, moved across the lizard's jaws for its whole length while a series of crushing bites was administered, and turned endwise for swallowing. These actions suggest that *A. squamatulus* feeds principally on prey of considerable size and strength, and probably of moderately slow movement, as lepidopteran larvae and beetles, and perhaps orthopterans. The contents of the fecal pellet also support this hypothesis.

When kept for a short time in a culture dish with a specimen of *Anolis nitens,* the young *squamatulus* was cowed and attacked by the former. The *A. nitens* was slightly larger and probably adult. An adult *squamatulus* constantly avoided a 116-mm. (snout-anus) individual of *Polychrus marmoratus* in a large cage. The latter has heavier jaws than *squamatulus,* and, like *A. nitens,* is known from seasonal forests at lower elevations, not from the cloud forest.

This large anole is usually emerald green dorsally and on the proximal part of the tail. The distal part of the tail is brown with black bars. Chin and throat are chartreuse, with the rest of the venter a more yellowish green. The dewlap is orange with yellow stripes (seven in one animal) running across it, and a yellow rim. One individual had red on the anterior part. Posterior to the forelimbs is a series of dusky bars across the back. Similar bars occur on the dorsal surfaces of tail and limbs, though sometimes absent from the forelegs. A young one of 42 mm., snout-anus, had 9 dorsal bars on neck and trunk (darker and more prominent than in the adult); the tail was completely ringed by broad dark bands. Ventrally, however, only the legs and distal part of the tail were dusky, in contrast to the more extensive duskiness of the adult. An adult which was green when it ran from the leaf of a tree fern up the trunk of a small tree changed suddenly to brown after a few minutes.

Iguana iguana (Linnaeus).—No specimens of this lizard were collected; the only ones seen in 1951 were on the peninsula extending into the northeast part of Lake Valencia, west of Maracay. Here they were relatively well protected from disturbance on private land and occurred in numbers in the larger trees along the lake shore. As we approached one tree an iguana fell from it at least 6 m. to the ground, alighted with a loud thud on its venter, then after a brief hesitation ran rapidly to the lake and hid under water in the aquatic vegetation. The poor farmers are said to remove the eggs from gravid females, then close the incision roughly with wire before releasing them. Probably most individuals treated this way die in a short time. Sexton and Heatwole saw this iguana on Zorro Island, in Lake Valencia, in 1956.

Polychrus marmoratus (Linnaeus).—This lizard was not found in the cloud forest; our two captures were made in warmer areas of deciduous forest. One was in the Botanical Gardens in Caracas in early May, at an elevation (about 925 m.) nearly as high as Rancho Grande. Because Caracas is in a trough-like valley extending east and west, with high mountains between it and the nearby coast cutting off clouds drifting in from the Caribbean, the area is much warmer and dryer than Rancho Grande. This individual was first seen on the leaf litter under the nearly bare deciduous trees covering the north-facing slope of the hills in the Gardens. It was captured after it moved onto a stump.

The other was taken at the edge of a patch of deciduous forest on the slope above Turiamo Pass on the west, at an altitude of about 500 m., November 9, 1951. It had been dropped, uninjured, by a hawk (probably *Leucopternis albicollis*) when the bird was startled by our sudden appearance. The lizard lay perfectly still on the leaf litter until a net was put over it. Beebe (1944) mentioned taking a specimen from the stomach of *Leucopternis albicollis*.

Our specimen (UMMZ 124309) from Turiamo Pass was kept alive at Rancho Grande for about two months, where it fed readily on grasshoppers, many of which were 45 mm. long. Some grasshoppers were caught by waiting for the insect to approach, then grasping it with a quick turn of the head. At other times the lizard ran to the grasshopper; once it jumped from the side of the cage through an arc of 180° to the prey. Once caught, these large insects were crushed with half a dozen slow closures of the jaws, then turned and swallowed head first. The lizard lapped, with scarcely extended tongue, drops of water sprinkled in the cage. Except when capturing prey its movements were slow and deliberate, using bottom, top, and sides of the cage of hardware cloth. Sometimes it hung from the top of the cage by all four feet for hours, even sleeping in this position. At other

times it slept on top of branches in the cage, its body and head resting parallel to the branch and its feet clutching it in the fashion of many species of *Anolis*, the hind feet extended nearly full length behind it. The distal third of its tail extended at right angles to the branch. When the lizard awoke as Test approached the cage, this bent end of the tail waved slowly back and forth, a position and movement which probably have protective value in directing a predator's strike away from the body.

In the daytime this captive lizard was green; asleep at night it was grayish brown, the same color as when it was captured. This is in contrast to the color of *Anolis carolinensis*, which is green when asleep. It suggests that *Polychrus marmoratus*, a rather heavy-bodied lizard, usually spends the night on branches, perhaps sometimes hanging beneath them, rather than among foliage.

Tropidurus torquatus hispidus (Spix).—Two were collected along stone walls beside the road between Maracay and Choroní Pass. One was at an elevation of 1050 m., the second at 620 m. in savanna. This species was not observed along the road between Maracay and Rancho Grande, where less xeric conditions prevail.

Family Teiidae

Ameiva ameiva praesignis Cope.—A specimen was collected on the interior side of the mountains at an elevation of 525 m. by Pablo Carmone. The dorsal stripe was almost lemon yellow. Others were seen in the same area; one was found dead on the road at a slightly higher elevation. This species is common in warmer, dryer, and more open country than cloud forest, occurring with *Cnemidophorus l. lemniscatus* but in less abundance.

A single green-tailed individual of either this species or *Cnemidophorus lemniscatus* was seen a few times at Rancho Grande in the fall of 1951 and one similarly in January, 1960. Glimpses of the green tail did not permit complete identification. Both were along the driveway at the southwest-facing front of the building, where they escaped into holes at its base and were never captured. This suggests that individuals sometimes come up the warm, open roadway from lower elevations, probably the Aragua Valley, in the non-rainy season and find the clearing at Rancho Grande suitable for at least short stays.

Argalia marmorata Gray.—Four specimens were obtained, all close to Rancho Grande. The field data indicate that this is an arboreal species. One individual was obtained about 2 m. above the ground in the space between the still clasping base of a dead palm (*Iriartea*) leaf and the trunk, whereas another fell out of a tree from a height of 10–15 m. A third was found in a ground-level room of the Station building. The smallest was in a wire tray

used to catch leaves from the forest canopy. It is conceivable that it had climbed into the tray after falling from the canopy and had found the leaf-covered bottom, even though only 0.5 m. from the ground, a satisfactory substitute for a tree limb, at least temporarily. It could easily have crawled out of the trap through the mesh or over the sides. Its morphology and what little we know of its habits suggest that *Argalia marmorata* may be ecologically an arboreal counterpart of *Proctoporus achlyens,* living in the epiphytic leaf litter which accumulates on the larger branches of trees. Such habits could easily account for the small numbers of this species in collections. All our specimens were found in daylight.

Our specimens, in preservative, generally fit the description given by Boulenger (1885). Only one (the largest), however, is olive dorsally with reddish brown marbling; the others are grayer and darker and have blackish marbling. In all, the facial bars and the subterminal ring on the snout are black. The tip of the snout is whitish, slightly clouded in one. Field notes give the fresh color of this tip as yellow (in UMMZ 120329). The smallest has a red-brown longitudinal band back of the eye and one back of the ear; in the other three these are less distinct.

The throat in the three largest has several small red-brown spots, mostly lateral, whereas in the smallest the ventral surface of head and trunk are practically immaculate and yellowish. The ventral surface of the tail is faintly dusky, with indistinct darker spots in the female, UMMZ 120329, which also has a dusky belly and chest. In the male, UMMZ 120330, the belly is slightly dusky, in the others scarcely clouded.

In contrast to Boulenger's description, our lizards have no cream-colored spots on the flanks, although the smallest has two faintly indicated white spots anteriorly on the sides.

As shown in Table 3, there is apparently no sexual difference in number of femoral pores. However, the pores of the large male are larger and more prominent than those of the other three specimens. In the female (UMMZ 120329), the posterior row of anal scales has a scale in the central position in the row of five, whereas the other three specimens have an interscale groove in the center of the row. In one male (UMMZ 120330), the groove is indistinct and short, dividing the large scale in the center for only half its length.

Our female has a head which is proportionally shorter and narrower (Table 3) than in the males. The two large males show prominent swellings of the posterolateral parts of the head which produce a decidedly triangular head in dorsal view. In the female these swellings are absent and the head is no wider posteriorly than at the orbital region. In proportion, her tail length is shorter and less attenuate than that of the males. Though these

TABLE 3

CHARACTERISTICS OF FOUR SPECIMENS OF *Argalia marmorata* FROM RANCHO GRANDE

Characteristics	UMMZ 120328	UMMZ 120330	UMMZ 120331	UMMZ 120329
Sex	Male*	Male	Male	Female
Snout-anus length (mm)	82	62	41	78
Collar scales	11	8	11	9
Transverse scale rows between chin scales and edge of collar	15	16	14	15
Scales around middle of body	31	32	31	33
Ratio hindleg/snout-anus length	0.35	0.29	0.34	0.35
Ratio foreleg/snout-anus length	0.27	0.21	0.24	0.26
Femoral pores	10–10 larger	8–9	9–9	9–9
Ratio tail length/snout-anus length	1.80	1.85	1.61	1.27
Ratio head length/snout-anus length	0.265	0.261	0.278	0.231
Ratio head width/head length	$\frac{12.3}{21.7} = 0.567$	$\frac{9.2}{16.2} = 0.568$	$\frac{6.4}{11.4} = 0.561$	$\frac{10}{18} = 0.556$

* Testis 3 × length of that in UMMZ 120330.

tend to be characteristics of regenerated tails, no other features of form or color indicate that this is other than the original tail.

On the side, immediately behind each pelvic limb, is a group of small scales. In the female and the young male these scales are in series with, and similar in shape to, the dorsal scales. The result is that four transverse rows of dorsals slant backward behind the base of the hind leg, the scales in each row being smaller as one progresses ventrad. In the largest male (testis swollen and 5 mm. long; apparently sexually mature), however, these four rows of dorsals end abruptly on the side of the tail at a group of scales which are much smaller, more rounded, and not located in regular series with the large dorsals. The intermediate male, whose testis size indicates it is not sexually mature, has one row of slanting scales on one side only. It appears that the small scales immediately posterior to the hind legs do not increase in size as rapidly as the dorsals in maturing males and also that they tend to change shape from quadrangular to circular and elliptical.

Cnemidophorus lemniscatus lemniscatus (Linnaeus).—This species is very common in the lowlands; we have seven specimens from both sides of Portachuelo Pass up to 510 m. This is not much above the level of the Aragua Valley and they probably occur considerably higher on the inland side, as indicated by sight records for which no definite altitudes were recorded. The green-tailed lizard seen at Rancho Grande may have been this species rather than *Ameiva*. Limited observations indicate that their usual environment includes a combination of open ground for foraging and brushy areas for shelter, together with abundant sunshine and daytime temperatures of 28–30°C. When the trees are leafless in the dry season, this species sometimes enters the deciduous forests. In addition to hiding in brush when disturbed, individuals also use burrows in the ground for shelter.

In the Botanical Gardens in Caracas, this lizard is abundant. The altitude there is about 925 m., only a little less than that at Rancho Grande, but temperatures are higher, and conditions dryer and more sunny because of the usual absence of enveloping cloud (neblina) in the valley. This lizard and *Ameiva* forage widely over the closely cut grass, bare ground, and brushy areas. On one occasion a *Cnemidophorus* was watched as it pulled earthworms from mud, where plants had been watered, and ate them. An individual also ate the small yellow blossom of the introduced, fleshy, prostrate weed, *Portulaca oleracea*. Observation of the flower and the actions of the animal indicated that the characteristics of the blossom rather than a visiting insect or movement of the flower attracted this lizard; this suggests that plant material may be a regular part of its food. Neither earthworms nor plants were named by Burt (1931) as food for *C. lemniscatus*, nor were they included by Smith (1946), Fitch (1958), or Hardy (1962) for North American species of the genus. In the stomach contents of 25 young and adults of *C. l. lemniscatus* examined by Beebe (1945), a single flower bud was identified, but no earthworms. Burt (1928), however, wrote of two captives of *C. sexlineatus* which "fought over an alfalfa bloom until it was consumed" in his feeding experiments. As others have noted (Stejneger, 1901; Beebe, 1945), the rapid vibration of a lifted forefoot is highly characteristic behavior in the stops between short, fast runs. Brief observations of unmarked individuals suggested that they often restrict their activities to localized areas, as Carpenter (1959) has found with *C. sexlineatus*.

On November 8, 1951, Test collected, at the junction of the Comboto and Periquito rivers, an adult male (UMMZ 124324) which was brilliant blue except for the bright red top of the head. Another was seen nearby and one at Turiamo the same day. No intermediates between this coloration, which was brighter than those described by Burt (*op. cit.*), and the common one of brownish dorsum striped with yellow were seen. In the preserved

specimen the bright red has faded to brown, and the typical masculine pattern of stripes and spots has appeared on the body, though in low contrast. Brightly colored tails of lizards with the brown and yellow body pattern were always green in those we saw. Burt (*op. cit*), described blue tails but did not mention green ones. It is possible that he was working entirely with preserved specimens in which a yellow carotenoid pigment had been extracted or oxidized by preservative, leaving a blue structural color, as occurs in the North American snake, *Opheodrys vernalis.*

Euspondylus acutirostris (Peters).—A single specimen (UMMZ 125769), which agrees closely with W. Peters' detailed description (1862) of "*Ecpleopus* (*Euspondylus*) *acutirostris,*" was found alive on the highway through the cloud forest at Rancho Grande, January 21, 1960.

Of the many characteristics described by Peters in his detailed account of the single specimen known to him, our specimen (Plate II) differs in scalation in only the following ways (Fig. 1): internasal scale extends only to ends of nasals rather than along a small part of the loreals; interparietal equal to, not longer than, frontal; one occipital (right) touches parietal as well as interparietal; there are 4 infraorbitals rather than 3, and their heights are much less than the supraorbitals. These differences, except for the last, are minor and easily ascribed to individual variation. The difference in number of infraorbitals might also be individual variation. The difference in height of infraorbitals is more serious, though it is possible that Peters meant to write infraorbitals "as high as supralabials," with which our specimen would then agree.

In contrast to Peters' specimen, our female has no femoral pores. The sex of his is not given, and such a difference may be sexual.

The greatest differences occur in coloration. The dorsal white lines in our specimen are bordered on both sides by black, instead of only on the lower side, and they extend nearly to the end of the tail. However, Peters' specimen was nearly twice as long as ours (snout-anus), and deterioration of pattern with increasing size is common among reptiles. The stripes in Peters' lizard broke up on the sides to form a linear series of flecks which continued onto the basal part of the tail, suggesting a former stripe. In addition, the upper black borders of the stripes of our animal disintegrate into tiny dark brown flecks at three-fifths the way along the tail instead of continuing to near the end as the lower border does. This suggests that in a larger individual the upper black border might be so broken as to be unrecognizable as a line, while the lower border remained continuous.

Our specimen, in preservative, is grossly whitish on the venter, each belly scale having a tiny black dot near its center. Peters' animal, presumably also described from preservative, was greenish bronze ventrally. This color is

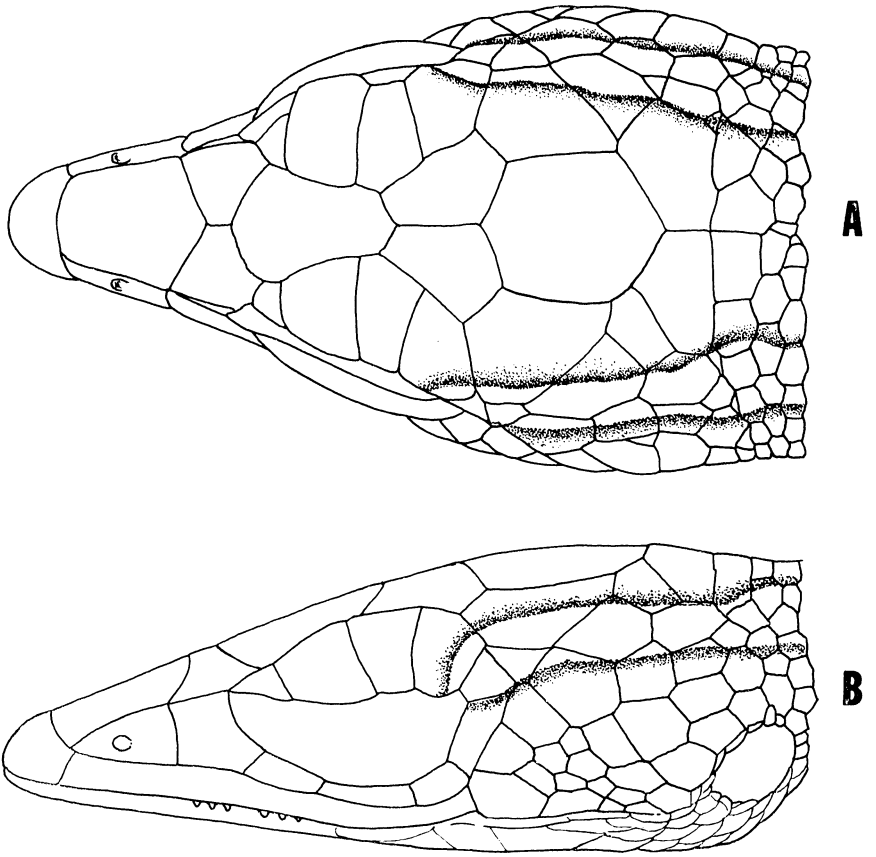

FIG. 1. Scales of head of *Euspondylus acutirostris* Peters (× 12). A, Dorsal view; B, Left lateral view.

easily within the possibilities of development in a larger individual, especially if it were a male. In *Proctoporus achlyens,* for example, the venter of adult males is strikingly different from that of adult females and young in its darker coloration.

The limbs of our specimen show no special flecking on the rear such as Peters described, but they do have nearly circular unpigmented spots, each bordered discontinuously by black. There is one of these on the rear of the thigh, two on the shank, and one on the ankle. The left foreleg has two and the right foreleg three. Though scarcely recognizable grossly as special markings in our young animal, they might in an older specimen fit Peters' description.

The greatest difference in coloration lies in the absence of lateral ocelli on the body, of which Peters reported seven to nine very small ones, black with white centers and widely spaced. Our specimen does, however, have three tiny, circular, whitish spots on each side—one in front of the foreleg, and one anterior and one posterior at the base of the foreleg. These are reminiscent of the light spots in young of *Proctoporus achlyens* which become the centers of ocelli in adults. It is possible that a sexual difference is also involved, with adult females having fewer ocelli than males, or even none.

With one exception, measurements of the two specimens are proportionally similar (Table 4). The slightly greater proportions in the hind limb of Peters' specimen might be expected in an adult male. The exceptional difference in the length of the fourth finger might be caused by injury in the type. A typographical error is involved in Peters' measurement for distance

TABLE 4

MEASUREMENTS OF TWO SPECIMENS OF *Euspondylus acutirostris*
(All percentages were calculated by F. H. Test)

	Peters' measurements of type		UMMZ 125769 (female)	
	Measurement in mm.	Per cent of snout-anus length		Measurement in mm.
Total length	157			
Length of head	15	26.8	24.9	7.5
Width of head	8	14.3	14.9	4.5
Height of head	6	10.7	9.3	2.8
Snout-anus length	56			30.1
Snout to foreleg	56 [!]			
Foreleg to hindleg	27	48.2	47.5	14.3
Length of tail	101	180.4	150.5	45.3
Foreleg	16	28.6	29.2	8.8
Hand	7	12.5	11.6	3.5
Fourth finger	4.5	8.0	10.6	3.2
Hindleg	21	37.5	34.9	10.5
Foot	12.5	22.3	17.6	5.3
Fourth toe	8.5	15.2	12.9	3.9
Width of body at middle	9			*
Height of body at middle	7			*

* Specimen not in condition for measurement.

between snout and foreleg; the figure apparently was copied from the one above it in his table.

In summary, our specimen agrees closely with Peters' description of *Euspondylus acutirostris* in all but a very few features. The differences are all within the range of individual, age, and sexual variation which might be expected. The narrow snout is appropriate to the specific name, and the striking color pattern is closely similar except for the absence of ocelli in our specimen.

In life our specimen had a brown (slightly grayish) back, the color gradually paling to light tan on the top of the tail. The sides of the body were brownish black changing abruptly to grayish tan on the sides of the tail. The two black-bordered lines on the dorsum (white in preservative) were canary yellow. The legs were brown above.

When found, the lizard was moving at a slow run on the concrete road. It did not speed up or dodge as the collector approached, and an insect net was easily placed over it. Even then it moved slowly and deliberately, flicking out its pale gray or tan tongue sparingly.

Placed in a transparent box with moist leaf litter it explored with deliberate movements in the daylight and hid itself at night. On the mornings of January 29 and 30 and February 6 it came out onto the surface of the leaves between 7:15 and 8:20 in a well-lighted room (one side glass).

The type described by Peters from "Venezuela" is the only specimen of this lizard previously reported. This, and the fact that the considerable amount of work done at Rancho Grande has produced only one specimen, indicates that *Euspondylus acutirostris* lives in places which are not commonly searched. Its movements, short, weak limbs, and slender body suggest a litter-inhabiting life. In the wet dark forests of Rancho Grande, however, one would expect dark coloration, as in *Proctoporus achlyens,* which is known to inhabit the ground litter there. The epiphytic litter, which occurs extensively and in depth on most of the large limbs, probably offers suitable conditions for lizards. In these conditions of less moisture and higher light intensity the relatively pale color of *Euspondylus acutirostris* would be more likely than on the forest floor. Such a microhabitat could easily account for its scarcity in collections and is in harmony with the circumstances of capture of our specimen. It was found on the concrete highway through the cloud forest, on the north side of Portachuelo Pass and about one kilometer away by the twisting road. Here large trees, with abundant epiphytes and epiphytic litter, overhang the road from the steep slopes above. Fallen plants, as well as animals which showed evidence of having fallen from the trees above, were frequently on the road. The very deliberate movements of our specimen are more likely for an inhabitant of epiphytic litter than for one of ground litter.

Proctoporus achlyens Uzzell.—This small lizard was largely cryptozoic in damp places, where it was collected beneath logs, in rotting vegetation, and under fallen palm petioles, as well as in and on leaf litter. A single individual found on the gravelly floor of a small gorge probably fell there. They were common in both mature cloud forest and second growth areas where leaf litter was thick and damp. Two particular logs along a trail seldom failed to have one or more beneath them. Individuals in leaf litter were seldom seen until flushed, when they sometimes exposed themselves briefly in taking refuge elsewhere in the litter. Escape movements were rapid. One individual was observed in a heavily shaded area on top of wet leaf litter accumulated in a slight depression. When disturbed it attempted escape into a hole in clay under the leaves. The hole was about 10 cm. deep and had probably been made by some other animal. Individuals usually twisted violently when held and easily lost their tails. A field note (F. H. Test) says they are "very delicate and easily killed in handling apparently if respiratory tract is constricted." Even one of the largest specimens, 51 mm. snout-anus length, died while it was being marked by clipping toes. Captives kept in moist leaf litter readily fed on *Drosophila* and were active only in daylight.

The species is apparently very common; 21 specimens were collected without particular effort at Rancho Grande (two of them by Jon Rood in 1960) and two were hatched from collected eggs. Two were found dead on the road in the summer of 1960, and in 1951–52, twenty-three individuals were examined, marked, and released alive in the field. None was recaptured. All of these were taken in the cloud forest zone between 940 and 1215 m. The one at the low altitude was in a deep, steep-sided ravine on the south side of Portachuelo Pass in which cloud forest conditions extended to a lower elevation than on the ridges at the same altitude. Two other specimens were collected (one by Ernst Schäfer) near Choroní Pass, about 10 km. east of Rancho Grande, at altitudes of 1500–1700 m., also in cloud forest.

Some information on coloration, in addition to that published by Uzzell (1958), can be given, based on both series of lizards mentioned above, those collected and those examined in the field. As stated by Roth and Gans (1960), examination of living individuals under varying conditions showed no evidence of luminescence from the lateral ocelli. The spots within the black rings are red in life but become white in alcohol. Our series of specimens strongly indicates that these ocelli develop and increase in number as the animal grows older. In recently hatched young, there are roughly circular light (red in life) spots on the sides, but they do not appear as ocelli because there is no black ring around each one as in adults. Instead, the lateral ground color is rather uniform, though generally darker from the head to

the axillary region than behind the axilla. Comparison indicates that the black ocellar rings of adults result from deposition of black pigment around the light spots, together with an actual paling of ground color between the rings.

Development of black ocellar rings is gradual and sexually dimorphic, occurring more rapidly and extending farther in males (sexes identified by dissection). In specimens (as UMMZ 117329, female) of 32 mm. snout-anus length, small black spots are present anteriorly where they are adjacent to the light spots but do not surround them. A male of 38 mm. (UMMZ 117332) has the black spots extending only slightly behind the forelegs, and none forms an ocellar ring. In adult females (UMMZ 117320 and 117324) there are black spots on the sides, but they are smaller than in males and do not form rings around the light spots, thus retaining the condition present in medium-sized young.

With the temporal increase in black pigment in spots on the sides of males there is positively correlated an increase in dark ventral pigment, the adult males having the belly closely patterned with blackish rectangles. Most small young have only a slight freckling on the throat although in one (UMMZ 117316) of 23 mm. from Choroní Pass there are strong black markings. Adult females have little if any more.

Young have a belly color ranging from pale red to bright red. In older individuals the color becomes less reddish and more yellowish. In one of 33 mm. the ventral coloration was mostly yellow, but "reddish in anal and pectoral regions." Another of 37 mm. was "pale orange," while one of 44 mm. was "pale reddish orange." Yellow and orange-yellow bellies were present also in our largest females (up to 51 mm.). In adult males, however, this bright color is either lost or masked by the abundant black pigment of the venter, which grossly gives the belly a gray appearance in life. Three live individuals (unsexed) as small as 39, 40, and 45 mm. were recorded in field notes as "gray-bellied"; they probably were males reaching sexual maturity. A male (UMMZ 117327) of 41 mm., however, had a "yellow" belly. At all ages the living animals have dorsally, according to our field notes, "blue and green iridescent reflections, especially on tail and top of head." The predominant dorsal color is a rich brown.

In late October, 1951, a nest of this species was found in the humus around the base of a cluster of small, narrow-leaved bromeliads which had been brought into the laboratory for another purpose. These plants had been growing about 15 cm. above the ground on a branch fallen long before and had accumulated a mass of plant debris 30 cm. in diameter, held together by roots of the bromeliads. This debris was moist, and much of it had broken down to granular humus. In a small cavity in the humus and about 5 cm.

beneath the upper surface of the debris were two elliptical pinkish white eggs (Pl. I), apparently recently laid, judging by their color and cleanness. A few inches away was a discolored, opened shell of similar nature, probably representing an earlier nesting and suggesting that a single egg is sometimes laid. No lizard was seen, but one could easily have escaped without detection. A peripatus also was found in the humus.

The two eggs were transferred to a can of moist humus and kept in a room with high humidity and a nearly constant temperature of 21°C. On December 28, one of the hatched young was found on the floor in another room and about 12 m. from the can. The other was under a wet cloth near the can. The egg shells had each been slit across the end, the break extending a short distance down opposite sides. The one which was nearly its original shape measured 10 × 7 mm. Hatching may have occurred a few days before December 28, for the eggs were not examined daily. In escape, the lizards had forced a hole through the cheesecloth cover on the can.

When found, our two hatchlings measured 22 and 23 mm. in snout-anus length. The eggs had been collected about two months before, when they undoubtedly were recently laid, but we do not know the length of time between hatching and discovery of the young. It probably was not more than a week at most, thus suggesting an incubation period of six to eight weeks. This is a reasonable period for a small lizard at the temperatures indicated. Rodgers and Memmler (1943) had incomplete evidence that the incubation period of *Eumeces skiltonianus* in the field, where temperatures probably were considerably higher than 21°C., was 4–6 weeks. Hunsaker (1959) found the gestation period for the ovoviviparous *Sceloporus cyanogenys* to be more than two months.

Using this indicated period of incubation of 6–8 weeks, the known size soon after hatching, and our 42 records of measured young lizards (including two collected by Jon Rood), we estimate that breeding occurs at Rancho Grande through most of the year. We have records of individuals measuring 22–26 mm. for January, March, July, October, November, and December (Table 5). These we judge to have been hatched no more than a month. With temperatures in the cloud forest varying little, all eggs must have similar periods of incubation, allowing us to set the time of deposition in eggs of our recently hatched lizards as roughly two months prior to hatching. Our captures show the greatest number of recently hatched young in December, suggesting that October, in the waning part of the rainy season, is the height of the egg-laying period. This peak may, however, be the result of unequal collecting effort and hence spurious.

If the rate of growth of *Proctoporus achlyens* were known, our measurements would allow us to indicate also the approximate hatching and deposi-

TABLE 5

EVIDENCE ON BREEDING SEASON OF *Proctoporus achlyens* AT RANCHO GRANDE

Month	Snout-anus length of lizards collected or handled alive			Indicated months of	
	Recently hatched	Older		egg deposition	hatching
Jan.	23	41		X	X
Feb.		37		probable (b)	probable (a)
Mar.	23 24	34		?	X
April		none		probable (b)	probable (b)
May		none		X	?
June		32 32		probable (b)	probable (b)
July	26	39		probable (b)	X
Aug.		38		X	probable (b)
Sept.		34	50 51	X	probable (b)
Oct.	23 25 2 early embryos	28 28 34 38 39	46 50	X	X
Nov.	24	29 31 37 40	46 53 53	X	X
Dec.	22** 23** 23 24 24 25 26	28 33	47 47 50 52	probable (a)	X

* The x's are based on our data on size at hatching and length of incubation period. (a) Indicated as probable because weather conditions are similar to the two adjacent months in which hatching or egg deposition is indicated. (b) Indicated as probable on the basis of growth rates known for other lizards.

** Hatched from October embryos noted above.

tion dates for young larger than 26 mm. In the absence of such data, we may use the scanty information available on the growth of small young of other kinds: *Eumeces skiltonianus* (Rodgers and Memmler, 1943), *Eumeces septentrionalis* (Breckenridge, 1943), *Sceloporus graciosus gracilis* (Stebbins, 1944), *Sceloporus olivaceus* (Blair, 1960). These show a rate of roughly 6–12 mm.

per month in wild individuals. These species are considerably larger as adults than *Proctoporus achlyens,* and probably were at somewhat higher temperatures, so we shall presume a rate of 4 mm. per month for it. Applying this figure to our measurements in the high 20's and low 30's we can obtain rough estimates of time of hatching, and by counting back two months more for each we can find probable months of their deposition as eggs. Such results, shown in Table 5, indicate reproductive activity for nearly all of the months for which more accurate data are not available; only for March is there no evidence of egg deposition and for May none of hatching. As these span a two-month period, which is the length of the incubation period, it may indeed be that eggs are usually not deposited in March, the last and driest month of the non-rainy season, and hence that few individuals of *Proctoporus achlyens* hatch in May.

Proctoporus luctuosus (Peters).—Our two specimens, which have been described by Uzzell (1958), were both taken within the Station building. One of these was examined in darkness while alive and showed no luminescence; the ocelli of both animals had centers which were yellow in life.

A specimen of a young animal (UMMZ 122361), collected at Rancho Grande by Jon Rood in the spring of 1960, has become available for comparison. With a snout-anus length of 41 mm., it differs from the much larger specimens in having the dorsal scales very weakly keeled and a considerable proportion of them weakly hexagonal rather than rectangular. Its coloration is more strongly patterned, with the back tan (less grayish than the adults) and sharply delimited by the gray sides. In the tan region is a paler dorsolateral stripe above each shoulder; but it is poorly defined because not outlined by black, as it is in *P. achlyens,* and also because it is slightly dusky. Also, in the tan area are fine black markings, varying from spots to short lines. The lines give the impression of roughly forming two zigzag, narrow lines down the anterior back. Ocelli on the sides are present in only one row, are less well developed than in the larger specimens, and extend back only half the distance between fore and hind legs. Below the ocelli are some light spots and some black ones, but they do not yet form ocelli, though they would probably develop into such in the adult.

The venter of head and body are nearly immaculate except for a tiny black spot on each side in front of the anus and three distinct lateral rows of black dots on each side (on outermost ventral scales). On the under side of the tail are four rows of punctate black dots anteriorly which soon become two rows extending about one-third of the length of the tail before changing into two ventrolateral dusky lines which enclose a central whitish line. Each side of the tail has a slender but distinct whitish line extending from the hind

leg about two-thirds of the way back. These white lines are weakly shown by one of the large specimens (UMMZ 117404).

Measurements are: scale rows around midbody, 45; longitudinal rows of ventrals, 10; total femoral pores, 25; hind leg, 19 mm.; ratio of hind leg/snout-anus length, 0.463.

Reasoning from the facts known about *Proctoporus achlyens,* we may presume that W. Peters' (1862) description of *luctuosus* was based on females. In *P. achlyens,* the adult females have ocelli in only one row, and they resemble the young in scale characters more than do adult males. Thus, the very weakly keeled dorsal scales of Rood's young *luctuosus* are similar to the condition described by Peters. If our reasoning is correct, two of the dissimilarities, mentioned by Uzzell (p. 5), between our adult males and Peters' description are accounted for.

In Uzzell's key (p. 14) the first separating character is the light dorsolateral line. To key down our young specimen to *luctuosus,* one may modify the key to read:

1a. Light dorsolateral line present, at least on shoulder.....2
1b. Light dorsolateral line absent.....5
2a. Loreal absent, a pore on each anterior preanal scale of males; venter of adult males immaculate cream.....*P. shrevei*
2b. Loreal present; no pores on anterior preanal scales of males; venter of adult males blotched with black.....3
3a. Light dorsolateral line extending length of body; loreal quadrangular....*P. oculatus*
3b. Light dorsolateral line not reaching to hind legs; loreal 5-sided.....4
4a. Eight or fewer longitudinal rows of ventrals; light dorsolateral line with straight black edges, no network of black lines on back.....*P. achlyens*
4b. Ten longitudinal rows of ventrals; light dorsolateral line with irregular black edges; back with poorly connected network of irregular black lines.*P. luctuosus,* young
5a. Dorsal scales smooth; no light lines across lips; scales around middle of body about 34.....*P. laevis*
5b. Dorsal scales striate or keeled; light lines crossing lips from eyes; scales around middle of body about 46.....*P. luctuosus,* adult

From specimens of *achlyens* (a much smaller species) of the same snout-anus length, this young *luctuosus* is distinguished by the larger and broader head (width, 7.6 mm./length of head from snout to posterior edge of last enlarged scales, 11.0 = 0.691 in *luctuosus;* width 6.3/length 9.9 = 0.636 in *achlyens*); sides and back contrasting in general coloration instead of similar; head without dark marks back of eyes and on occiput; back with a poorly connected network of irregular black lines; sides of belly and anterior ventral side of tail with distinct, punctate, black spots instead of being unmarked or dusky.

Rood's specimen was taken "in woods near water trail," which probably means the secondary forest which has grown up among the planted *Casuarina*

trees in the semicircle once cleared of cloud forest directly above the building. This area has smaller trees, denser low vegetation, fewer epiphytes, dryer conditions, and higher temperatures than the surrounding primary cloud forest. This information and the fact that the two larger specimens were both found in the Station building suggest that *P. luctuosus* probably is an inhabitant of the altitudinal zone just below the cloud forest and that it occurs at Rancho Grande only because conditions of that kind reach up along the road through the cloud forest and are expanded around the Station building. If this be true, *luctuosus* and *achlyens* probably replace one another altitudinally in general and ecologically in particular. Very little work has been done in the forest zone below the cloud forest; its extent has been greatly reduced by dry-season fires.

Tretioscincus bifasciatus kugleri Shreve.—Our single specimen, a young one with snout-anus length of 25 mm., was caught on the lower trunk of a large palm at Cata, which is at sea level, July 23, 1956. The palm was in the open in a grassy area beside a dirt road and only a few meters from a clump of bushes. The lizard's general appearance and actions were exceedingly similar to those of young of the North American skink, *Eumeces fasciatus*.

This individual (UMMZ 124314) fits Shreve's description (1947) well, though slightly smaller than any of his specimens. It has 16 scale rows at mid-body and 31 rows between occiput and rear border of thigh; there are no femoral pores. Brown on the dorsum is confined to the inner halves of the two median rows of scales except for a few a short distance back of the fore legs, in which the margin of the outer half is partly edged with brown.

In addition to the differences between the races *kugleri* and *bifasciatus* mentioned by Shreve, our specimen also differs from a series of 15 (*bifasciatus*) from the Santa Marta Mts., Colombia, by having the light, dorsolateral stripes closer together. In ours the light stripe at midbody passes down the middle of the second longitudinal row of scales from the sagittal plane. In the Colombian specimens the light stripe in the same region is on the outer half of the second scale row, and in some it is so far lateral as to extend onto the third row. The light stripe in ours is also poorly developed, actually being discontinuous from scale to scale under magnification.

Three larger specimens from the states of Yaracuy, Trujillo, and Carabobo, Venezuela, (UMMZ 55936–7, 57412) have their light stripes even more poorly developed than in ours, while a fourth (UMMZ 55935, from Boqueron, Edo. Yaracuy, the same locality as UMMZ 55936) has a strongly defined stripe. This specimen is also the palest ventrally. Apparently the quantity of black pigment is controlled both dorsally and ventrally by the same genetic factors, with the result that individuals with heavy ventral spotting also have light stripes encroached on by black. Of these four specimens, one has

the light stripe in the middle of the second scale row, one has only a small part on the inner half of this row, and two (including the palest specimen) have it reaching no farther than the middle of the second scale row.

Ventrally our specimen is heavily spotted with black. The enlarged throat scales are largely light, but a median row and one lateral row on each side bear small, irregular black spots. The middle anterior ventral scales are each about one-fourth black (dark brown under magnification); the pigment is in the proximal part of the scale and is overlapped by the light distal part of the scale next anterior. The extent of pigment in each scale increases laterally and posteriorly, extending beyond the edge of the overlapping scale on the anterior belly and coloring more than half of each scale in front of the hind legs. Beebe (1945) described a living specimen (presumably of this race) from Caripito as having "chin and throat immaculate bronzy white, chest and abdomen bluish-white." Shreve did not describe the ventral coloration of his specimens. A series of specimens in The University of Michigan Museum of Zoology from the Santa Marta Mountains, Colombia, which still show the color well and are of the typical race, exhibit considerable variation, but none is as heavily spotted as ours, though UMMZ 54716 of 47 mm. snout-anus length approaches it. Two young of size comparable to ours are both paler, but one (UMMZ 54721) of them also approaches it. Another large specimen (UMMZ 54712) is nearly immaculate on lower head and body. Apparently there is much individual variation within the race and little, if any, change from young to adult in ventral coloration. It may be that *kugleri,* which is darker dorsally than the typical race, may also average darker ventrally.

Field notes on our fresh specimen described it as "Dorsally black with 2 brassy lines; blackish ventrally. Tail bright blue as in *Eumeces fasciatus.*" Two of the larger specimens described by Beebe (1945) from Caripito had "gold" dorsal stripes and a third had "creamy white" stripes.

Family Amphisbaenidae

Amphisbaena alba Linnaeus.—An individual of 49.4 cm. was found dead September 1, 1956, 1 km. north of Villa de Cura on the highway to Cagua, in a region of low hills with pastures and savanna. This place, altitude about 500 m., lies about 15 km. southeast of Lake Valencia, in a low divide between drainage into the lake and that of the upper Orinoco basin.

Family Scincidae

Mabuya mabouya mabouya (Lacépède).—This skink occurs on the Station building, in the warmer, dryer parts of the young second growth forest around it, and along the road nearby. It was never seen in the cloud forest proper. It was most commonly encountered at Rancho Grande in 1960. Indi-

viduals may be more active and/or more apparent at this time (January–June) which is the latter part of the non-rainy season and beginning of the rainy season, whereas our records for 1951–52 and 1956 refer to autumn and summer, respectively. Two were found smashed on the road in late February and early March, 1960, one of them about 0.4 km. below Portachuelo Pass on the north side. This is in cloud forest where the road is cut through a ridge, providing considerable areas of exposed rock from which most of the large vegetation has been lost, thus producing warmer, dryer conditions in cloud forest.

On January 23, 1960, three large, plump adults were watched by A. R. and F. H. Test for several minutes from a distance of only 1.5 m. One ran about a meter, from the trail into a dense tangle of grass and dead plant material at the base of a spiny palm (*Bactris*), then up the trunk for 30 cm. into a spot of sunlight. The other two shortly afterward came out of the debris at the base, one following about 15 cm. behind the other. They paid little attention to people and dogs passing on the trail. Movements were similar to those of the North American *Eumeces fasciatus*.

At the west end of the Station building was a patch of dense grass about 1 m. high covering perhaps 175 sq. m. on a south-facing slope between the driveway and the edge of the second-growth forest above. At the lower edge of the grass, skinks were frequently seen and heard in 1960, often sunning themselves on a row of pieces of angular rock. About 9 A.M. on April 30, 1960, three adults and a young one approximately 10 cm. long were all in view at once here. The sky was brokenly cloudy. They were foraging in a narrow strip of cut grass and also back into the standing grass, which had a densely matted layer of fallen dead stems forming a canopy several centimeters above the ground. At times both adults and young climbed as high as 30 cm. in this tangled canopy. One drank a drop of water from the grass. The young lizard poked its head into fallen, rolled tree leaves which had lodged in the grass and sometimes flicked its tongue out as it foraged. The adults were about four meters apart, which suggests that they may be territorial. Foraging of the young one, while it was watched, was between two adults.

If this species is territorial, the gathering of three on January 23, noted in an earlier paragraph, may be indicative of breeding season. The smallest young found (February 17, 1960) measured 38 mm., snout to vent (95 mm. total length, with complete tail). This probably is considerably larger than hatching size. The small young may be highly secretive.

A specimen (UMMZ 124317) of 59 mm. captured December 6, 1951, had fresh colors as follows: dorsum of head and neck bronze, grading into brassy on hind neck and continuing thus to posterior (regenerated) part of tail, which was dusky; lateral stripe, flecks on sides, and venter of head old gold;

rest of venter to regenerated part of tail dull pale yellow, slightly greenish; mixed black and chestnut brown flecks on sides below lateral black band; iris black. There is no prominent difference in coloration in the three preserved specimens, of 38, 59, and 82 mm. The largest, surprisingly, has a complete, unregenerated tail and is 232 mm. long.

In the characters considered by Burger (1952) in his discussion of geographic variation, our three specimens show the following: width of dorsolateral black band, 3 scale rows (2 whole scales plus 2 half scales) in all specimens; supralabial under eye, no. 6; supranasals touching in one, moderate contact in one, broad contact in one (not correlated with size of animal).

Family Boidae

Constrictor constrictor (Linnaeus).—We did not find this snake, but the skin of one which was said to have been collected at the lower edge of the Park, on the outskirts of El Limon, was in the exhibition collections at Rancho Grande in 1951.

Family Colubridae

Chironius carinatus (Linnaeus).—Our specimens were taken at altitudes from approximately sea level near Ocumare de la Costa to Portachuelo Pass. In the vicinity of Rancho Grande all but one of our thirteen records are from the highway or areas of grass or modified forest close to it. The only exception is that of an enormous individual in the cloud forest about 300 m. southwest of the Pass and slightly below it, seen on September 30, 1951. It appeared to be about the same size (285 cm., total length) as that recorded by Beebe (1946) for British Guiana. When an attempt to catch it failed, it went out of sight down-slope at tremendous speed. Despite its being a moderately common snake, we have no records for October-December and February-March.

Although this species has a body form suggesting arboreal locomotion, and Beebe mentioned individuals "draped among dense foliage," all but one of ours, including young, were on the ground. Those found alive were active, probably foraging, in various hours of daylight, although the large eye suggests nocturnality. A road-killed specimen from about 1000 m. on the road between Maracay and Choroní Pass, June 28, 1956, had regurgitated a recently caught frog, *Eleutherodactylus* sp. When annoyed, individuals laterally compressed the neck and anterior part of the body very strongly.

A female captured a short distance below Rancho Grande on July 18, 1956, held four oviducal eggs, the largest 2.8 × 1.4 cm.

Like the specimens described from British Guiana by Beebe, ours varied considerably in coloration in life. Dorsally the colors ranged from brown,

through olive, to green. One had blackish flecks on the posterior part of the body. A pair of dorsolateral dusky stripes was more or less prominent on the body but did not extend onto the tail. Ventrally the color was some tint of yellow, suffused with brown on the posterior trunk of one (UMMZ 124282) which had a brown dorsum.

Chironius monticola Roze.—Our only specimen was found smashed on the road about 1 km. from Rancho Grande and north of Portachuelo Pass, June 14, 1960. The striping on the tail is quite distinct. Some of our specimens of *C. carinatus* (UMMZ 124274, -77, -81) have four stripes on the tail, but they are narrower, more intensely black, and more zigzag than in *monticola*. Those of *monticola* stand out also because the interlineal spaces are bluish white rather than the dusky of *carinatus*.

In number of posterior rows of dorsal scales, *C. monticola* is not so clearly separated from *carinatus* as suggested by Roze's description (1952). Four of our specimens of the latter (UMMZ 124275–7, -82) have the 10 rows he describes as typical of *monticola*. Another (UMMZ 124281) has an anal divided in only its anterior half.

On the basis of our limited data and Roze's account, we believe it probable that *C. monticola* is the characteristic form of the cloud forest and that *carinatus* is at Rancho Grande only because of the warmer and/or more open conditions along the road and in disturbed areas nearby.

Clelia cloelia (Daudin).—This species is represented by one individual, found dead near El Castaño, elevation 530 m., a few kilometers north of Maracay on the highway to Choroní.

Dendrophidion percarinatum (Cope).—This was one of the most commonly seen snakes at Rancho Grande, in 1951 and 1956, where it was active in daylight on the floor of moist secondary and primary forests. One was found coiled on top of a fallen dead leaf of the stilt palm, *Iriartea*. These leaves, because of their great bulk of large leaflets, often stand 0.25–0.5 m. above the forest floor and are used as shelters by frogs. When handled, *Dendrophidion percarinatum* did not try to bite but twisted violently and rubbed the anal region over the captor's arm. One held underfoot, in being captured, spread laterally the skin at the back of the head (but not the whole neck) and struck hesitantly and indecisively several times. It also vibrated the tail rapidly, as did another when it was held down by a stick.

Our specimens came from altitudes of 870–1150 m., and from the months of September, November, December, and January. In The University of Michigan Museum of Zoology is a specimen collected "near the Station" by Jon Rood, March 21, 1960.

A 28-cm. individual marked in cloud forest November 16, 1951, was recaptured 43 m. away six days later, at which time it was moving toward the

place of first capture. Many of those seen were moving slowly through the leaf litter, in a manner suggesting foraging, when first observed. A number of species of frogs occur in leaf litter, and a captive *Dendrophidion percarinatum* ate *Prostherapis trinitatis, P. neblina,* and *Eleutherodactylus cornutus maussi.* This same snake, however, refused *Bufo granulosus* and the Rancho Grande gecko, *Gonatodes taniae.* The toad does not occur in Rancho Grande forests, and the lizard, although present at Rancho Grande, was not found on the forest floor.

Most captured individuals were bright yellow beneath the body and orange on the urosteges. One of 73.2 cm. had a milky pink venter resulting from the early separation of the cornified outer epidermis. When scales were cut for marking, this outer layer came away, exposing the usual yellow beneath. Two specimens were recorded from life as having gray venters. One was the recaptured young snake referred to above. It had some yellowish around the angles of the jaw, and the lateral ends of the ventral scales were pinkish, but there was no evidence of preparation for shedding (eyes were clear) and no yellow appeared when scales were cut. It was in this condition both times of capture. On the basis of the diameter of the base of the tail this individual was recorded in the field as probably a male. Our only specimen (UMMZ 124070) for which we have field notes saying it was gray-bellied is also a male (dissected) and also small (28.0 cm.). The color difference is not strictly sexual, however, for a male (UMMZ 124071; dissected) had a yellow venter, as did UMMZ 124072, a female. As all those for which we have notes of a yellow venter were of adult size and the only two noted as gray were small young, an age difference is indicated. Additional data will be necessary for proof.

Two specimens (UMMZ 124067–8) captured September 26, 1951, measured 51.3 cm. and 53.0 cm., respectively. Colors, noted in life, were as follows: underparts yellow from snout to anus with a little orange-yellow at the posterior angle of the jaw; underside of tail orange; ground color of upper parts dark glossy brown, the dorsal scales on the anterior part of the body having one or two sides margined with pale green; black band from each eye curving medially on occiput until they almost meet. In contrast, the gray-bellied, marked animal mentioned earlier, a smaller individual (28.0 cm.), had distinct blackish bars across the body all the way to the head, but no black band from eye to occiput, though there was some blackish pigment about the eye. One uncaptured, large individual was recorded as having the dorsal ground color tan-brown anteriorly, darker posteriorly.

Twice, two individuals were found very close to one another. One pair was on the Pico Periquito trail at 5 P.M., October 26, 1951. Though their sexes were not determined, their lengths of 54.7 and 73.2 cm. suggest male

and female. Perhaps this was mating season. The larger snake was almost ready to shed. On the morning of December 29 two males (UMMZ 124070, 27.5 cm.; 124071, 70.9 cm.), recorded in the field as gray-bellied and yellow-bellied, respectively, were active at the roadside after a night of heavy neblina.

Our largest specimen (UMMZ 124069), 78.3 cm., contained eight ovarian ova measuring 30–36 mm. long after being hardened by preservative in the body. She was collected November 13 on the trail to Pico Periquito. This indicates that some individuals, at least, lay in the non-rainy season. Another, of 64.8 cm., collected on December 31, had enlarged ova, the largest 7 mm. long. Our smallest young, 28 cm., were taken in November and December also.

Dryadophis boddaertii (Sentzen).—Our only living specimen was found on the ground beside the trail to Pico Periquito, at an altitude of about 1124 m., in daylight. It immediately headed for a large buttressed tree about 3 m. away and began to climb, using exaggerated lateral undulations, though it was only 35.3 cm. long, snout-anus.

This animal differed somewhat in coloration from that described by Beebe (1946) and Stuart (1941). The venter in life was pale straw color anteriorly, becoming more yellowish posteriorly until the urosteges were olive-yellow. Dorsal anterior blotches were brownish red bordered by black; posteriorly the blotches became less reddish. The iris was reddish chocolate, and the tongue black.

A single specimen was found dead on the road on the south side of, and close to, Portachuelo Pass, April 23, 1960.

Imantodes cenchoa cenchoa (Linnaeus).—Evidence from road kills indicates that this snake is much more common than observations of living individuals show (Test and Roze, MS). All of our 5 specimens are from cloud forest within 1 km. of Rancho Grande, and all but one were found dead on the road.

The single living one was found the morning of October 14, 1951, hidden between two of the broad overlapping, horizontal leaves of a plant of *Carludovica* sp., and about 1 m. above the ground. It was very docile and did not completely uncoil as it was slid into an insect net and then into a jar. In the net it hid its head among its coils rather than attemping escape. Held in captivity for about two months, this snake drank long and vigorously after being kept without water for a few days. It ate *Prostherapis trinitatis* and *Eleutherodactylus terraebolivaris,* but refused moths and large leafhoppers which came to our windows at night. The pale yellow iris of this specimen surrounded a vertical pupil which was a narrow slit in daytime. The tongue was gray. The saddles were rich, deep, reddish brown on a ground

color of dark tan-brown. Venter was pale pinkish, becoming slightly yellowish at the sides, and was irregularly speckled with dark brown and blackish.

Evidence from both field and laboratory, mostly indirect, indicates that *Imantodes c. cenchoa* is crepuscular and/or nocturnal. Our captive became active in the early evening. Beebe (1946) wrote that this species was "very active, tying itself into knots" when caught, but it is uncertain whether he was referring to individuals caught at night or in daylight. Our docile snake may have been thus because it was caught in daylight or because of the relatively low temperatures of Rancho Grande; Beebe's specimens were observed in the lowlands of British Guiana. Though its form is that of an arboreal snake, it must travel commonly on the ground or so many individuals would not have been killed on the highway.

Leimadophis melanotus (Shaw).—We have three specimens, all collected in the fishing village of Turiamo, northwest of Ocumare de la Costa, one of them by José Garcia. The one collected January 19, 1952, regurgitated the anterior half of a small lizard, *Gymnophthalmus speciosus.*

Although Ruthven (1922) found *Leimadophis melanotus* as high as 1700 m. in the Santa Marta region of Colombia, apparently none of his specimens came from cloud forest, for he recorded the lower limit of this formation at 1850 m. in the Santa Marta Mountains. Roze (1964) has stated, without documentation, that this species "seems to invade Rancho Grande, but it is not found in the dense cloud forest; it is an element of tropophytic lower regions . . . ." This indicates that it sometimes may occur in the warmer, dryer, open areas around the Rancho Grande buildings and road. We never found it around Rancho Grande, though *L. zweifeli* is very common there. The statements of Ruthven and Roze and the fact that *L. zweifeli* occurs in open areas at Rancho Grande suggest that *L. melanotus* is limited by the cooler, wetter conditions of cloud forest rather than by competition from *L. zweifeli.*

Leimadophis zweifeli Roze.—This was the snake most commonly encountered in the cloud forest (Test and Roze, MS) although it was not found in any of the lower zones. Nearly all of our 48 observations were at forest openings, such as mountain brooks, paths, clearings, fallen trees, and open secondary forest. In such places it occurred both on bare ground and lawn as well as in dense herbaceous vegetation. At some of these places it overlapped the habitat of *Dendrophidion percarinatum* slightly, but mostly the ecologic ranges of the two species were complementary, *Dendrophidion percarinatum* foraging over the relatively open floor of primary forest. Both species were found to be diurnal and to feed on amphibians. Their habitat distribution clearly reduces competition between them.

About half of our observations of *Leimadophis zweifeli* were made near streams, where the diurnal frog, *Prostherapis trinitatis,* occurs in considerable

numbers. Several times individuals were seen foraging in such places. The snake would move slowly along through dense herbaceous vegetation and over open ground, poking its head under stones. After a frog was flushed, which was usually at distances of 25 cm. or more, the snake moved very rapidly toward it, then stopped and moved its head left and right several times through a distance of 1–2 cm., before changing direction toward the new position of the frog and continuing slowly toward it, flicking its tongue as it went and occasionally opening its mouth. Sometimes an individual flattened its neck dorsoventrally as it foraged. If several frogs were nearby and jumped as the snake rushed forward, the snake continued its rush, striking at the nearest frogs even though they were out of range. None of these times did the snake capture a frog, and it is probable that it seldom does unless the snake is hidden in the approach or is lying quietly and is approached by the frog or unless the frog is cornered among or under rocks. All the frogs we saw made a series of rapid jumps to a distance of two or three meters rather than hiding under nearby stones, which is their usual method of escaping humans. One adult female *Prostherapis trinitatis* did not flush when the snake passed in full view about 120 cm. away. Once a 27-cm. (snout-anus) *Leimadophis zweifeli* grabbed an adult female *P. trinitatis* as she passed a small burrow in the bank in which the snake was lying. It released her when it could not get her back into the burrow, then caught her again. As she was a marked frog in which we were interested, we then allowed her to escape.

A snake 49 cm. long was found one day trying to swallow a large female of *Eleutherodactylus cornutus maussi* which was 6.6 cm. in snout-anus length. Of bulky build like a toad, the frog inflated itself as a toad does, then measuring 12.3 cm. in girth. Unable to swallow it from the rear, the snake gradually worked around to the head but was still unsuccessful. The snake finally released the frog when they were moved into better light for photographs. The latter died an hour later.

Captives fed readily on *Prostherapis trinitatis* and *P. neblina,* swallowing them directly while still alive, in the manner of *Thamnophis* and *Natrix*. Twelve snakes were forced to attempt regurgitation when captured in the summer of 1956. Eight of these produced no food, one contained an adult *Protherapis trinitatis* and six tadpoles, another had six tadpoles (probably *Prostherapis*), another a female *Eleutherodactylus terraebolivaris,* and one regurgitated the hind legs of an *Eleutherodactylus cornutus maussi.*

Nine snakes were marked in the summer of 1956 by clipping caudal scales, and two of these were recaptured three times each. One originally captured at a small roadside ditch in front of the Station on June 29, 1956, was subsequently captured at the same site July 30 and August 2. The other, first taken July 8, 1956, at a small stream was recaptured there August 18, and

on August 24 at a path 23 m. west of the original location. These data suggest that an individual restricts its activities to a rather small area. Two snakes marked in October, 1951, were not identified again.

When disturbed or handled these snakes flattened the neck dorsoventrally for a distance of about 7 cm. behind the head. This reaction was never followed by striking or any attempt to bite, and at no time did any of this species bite us. They did, however, smear cloacal contents on the captor when picked up.

Predation upon this species was observed once. An unidentified hawk was flushed which had an individual in its talons. One snake we captured had been blinded in one eye, possibly by a predator.

On April 8, 1960, a female (39 cm.) containing three eggs with leathery shells, probably nearly ready for laying, was found smashed on the road at Portachuelo Pass. The flattened empty shells, when fresh, measured 30 × 11, 29 × 13, and 29 × 11 mm. About 1.5 m. from her was a dead male, 37.5 cm., which suggests that he may have been following her. In 1956 an individual collected July 4 contained five large ova. Our smallest young, two of 18 cm. and one of 14 cm. snout-anus, were found in December, 1951.

Our specimens of *Leimadophis zweifeli* were darker in life than the descriptions given by Beebe (1946) for *L. reginae*. The major part of each dorsal scale was black, with only a spot of yellow posteriorly. UMMZ 124229 was unusually dark, having very little yellow visible dorsally. The venter varied from completely yellow to completely orange. In one intermediate specimen the anterior third was yellow and the rest orange; in another the orange belly scales had yellow lateral margins; a third was yellow with orange on the median borders of the caudals. Small young of 19 cm. had the light color more orange than adults, both dorsally and ventrally. One had a distinct, though narrow, orange collar immediately back of the head, though in others it was clouded with black pigment and was completely obliterated in snakes of 39 cm.

Our largest individual (released) had a snout-anus length of 49.3 cm.

Leptodeira annulata ashmeadi (Hallowell). — Our single specimen (UMMZ 124214), 43.8 cm., obtained December 23, 1951, was flushed in daylight among stones on the flood plain of the Río Periquito near the village of La Trilla, elevation about 150 m. This is on the coastal slope of the mountains.

Ninia atrata (Hallowell).—All but one of those found were dead on the highway through cloud forest in the vicinity of Portachuelo Pass, with dates in January, April, May, July, and August. A single specimen was picked up on August 1 as it crossed the road through cacao and rubber plantations about 2 km. south of the Turiamo-Ocumare road junction. This species is

thus indicated as a snake of humid forests, from approximately sea level to at least 1090 m., and nocturnal. None was seen in daytime.

Oxyrhopus petola (Linnaeus).—Five individuals were found, all but one of them dead on the road near Portachuelo Pass, in the cloud forest zone. The iris of one was noted as red.

The living snake was found in the daytime coiled beside a piece of iron pipe near a trail through the cloud forest. It was resting on cut herbaceous vegetation and small stones and was partly covered by leaf litter. During a month in captivity it did not feed on any of the amphibians (*Eleutherodactylus terraebolivaris, Atelopus cruciger, Prostherapis neblina,* and *P. trinitatis*) offered it. Janis Roze (personal communication) says the diet of this species includes other snakes.

Jon Rood kindly made available to us information he obtained in 1960 on reproduction. A female he obtained at Rancho Grande laid in captivity three eggs which were first noted on June 1, and the next day seven were present. They were white and 2.5 cm. long. Two hatched, after they were brought to Ann Arbor, on September 2–3; the young snakes measured 155 and 164 mm. in snout-anus length. The parent was crossing the highway near the Station building at night when captured. This, with our data, indicates that *Oxyrhopus petola* is nocturnal.

Umbrivaga mertensi Roze.—Two specimens of this recently described genus and species (Roze, 1964) were obtained at Rancho Grande on June 26 and July 2, 1956. The former (UMMZ 124215) is a young male of 132 mm., with an anterior pattern of dorsal bands. The other (UMMZ 124216), probably adult, as a partly extruded hemipenis is well developed, is 292 mm., without distinct dorsal color pattern anteriorly. Roze has described their scalation and has commented on the peculiar dentition of this genus, for which he had evidence of adaptation to egg-eating habits.

Notes on colors of our two specimens in life are as follows. Adult: dorsum dark gray, almost black, except for rostral and upper labial scales which were light cream; venter light cream except for a suffusion of gray on the extreme lateral edges of the ventral scales. Young: dark areas of upper head velvety brown; nape black, followed by a band of tan; succeeding blotches blackish, alternating with lighter areas of dark tan; dorsum, between longitudinal black stripes, blackish brown; venter, streak across upper labials, and lowest three rows of dorsal scales light cream, the anterior ventrals suffused with gray in increasing proportions back to midbody where the scales were gray. None of this dark ventral coloration shows in the preserved specimen.

The young specimen was found in the Station building; the adult was on leaf litter in the Water Trail, which leads through both secondary and primary forest back of the building. One other of the seven specimens recorded

by Roze had ecological data; it was "collected on ground among wet leaves climbing the Portachuelo Pass." Four were obtained in June and July, the holotype in April, and two were not dated. All of these dates fall in the first half of the rainy season, and Roze suggested that this might be indicative of some local migration. It is also possible that this period is its breeding season (as our evidence indicates for some other snakes at Rancho Grande) and that more extensive movements by individuals in connection with breeding cause it to be more readily seen by collectors.

Urotheca lateristriga multilineata (Peters).—Not found in 1951–52 and 1956, this species is represented in our records only by dead individuals from the road in cloud forest near Rancho Grande. Our three specimens have dates of March 6, May 12, and June 14, 1960, the last found close to a dead *Urotheca williamsi* on the same date. All were in wet ravines, one at Rancho Grande, one near Portachuelo Pass on the north side, and one about a kilometer below it on the south side. The first mentioned (UMMZ 124222) was recorded in field notes as having the belly orange-yellow. Dorsally there was a broad mid-region of dark gray, below which on each side were, in order ventrad, stripes of dusky light brown, dark gray, white (narrow), and black (narrow).

This species is probably secretive, as *U. williamsi* appears to be. However, the individual described above was killed sometime between 10 A.M. and 12:30 P.M., which indicates some diurnal activity. With our records of this species and *U. williamsi* showing that they are found in the same kind of places, additional study of their ecology would be interesting.

Urotheca williamsi Roze.—This species was encountered only in 1960, when one was found February 27 under loose dead leaves in the trail to Pico Periquito at an elevation of about 1250 m. and two were found dead on the highway a short distance below Portachuelo Pass on the north side, March 17 and June 14. Field notes on UMMZ 124224 give its belly as gray with pinkish flush and the interstripe areas posteriorly a pale brown.

This species is small and perhaps nocturnal and secretive. With its neutral coloration and the low light intensity in the cloud forest these characteristics would make it difficult to find in casual observation.

Dipsas latifrontalis (Boulenger).—Three individuals were found dead on the road through cloud forest near Portachuelo Pass, February 16–March 2, 1960. None was seen in 1951 or 1956. The clustering of these dates in the latter part of the dry season suggests that this species may inhabit principally the dryer zone below the cloud forest, coming up into the latter only in the non-rainy season. It is probably nocturnal.

Dipsas variegata Duméril, Bibron, and Duméril.—Three of the five specimens were found dead on the highway, with dates of April 28, 1960, and

June 30 and July 30, 1956, all in the rainy season. Probably this species is an inhabitant of the cloud forest, remaining in the more moist parts of the forest in the non-rainy season. All records are from above 1000 m.; a dead individual left by a visitor on August 26, 1956, is of unknown origin.

The fifth specimen was killed by a visitor to the Biological Station on the road nearby, September 2, 1956. It contained 5 large ova of approximately equal size; one was 28 mm. long.

Family Elapidae

Micrurus mipartitus semipartitus (Jan).—This coral snake is common in the cloud forests near Rancho Grande. Despite its prominent coloration, one would likely underestimate its abundance relative to some other species if using sight records only; it probably is often hidden in leaf litter and in the interstices of rotten outcrops of rock covered by litter, where we have seen it.

Our records are well scattered through the year except that four were made in August, twice as many as in any other month.

Three individuals seen by Test were moving about openly on the surface of the litter in broad daylight. All were approaching, showing that they were not flushed from cover by the observer, and no other cause of flushing was recognized. All were moving slowly; one poked its head repeatedly into the accumulated litter at the base of a tree, as though foraging. This individual had been seen about an hour earlier moving over the leaf litter about 12 m. away. None paid any attention to the observer until touched. A fourth coral snake, a young one, was moving on the concrete highway in late afternoon. A fifth was seen to emerge momentarily from rotten rock covered by litter before slowly disappearing into it, also in daylight. Sexton found on the highway at noon a dead coral snake that had not been there at 9:00 A.M. These data are strong indication that *Micrurus mipartitus* moves about, probably foraging, during daylight and frequently on the surface of the ground. Although the light intensity was reduced by the forest canopy and high overcast, none of these observations was made in the twilight of fog. One of these diurnal snakes seen in 1960 was unusually large. By comparison at the time with the size of the observer's finger, it was estimated to be 2 cm. in diameter.

Mertens (1956*a*) found that *Micrurus frontalis* too is active in daylight, in captivity, especially when it is hungry. This he points out is in contrast to his experience with *M. corallinus,* which mostly remained concealed in daylight. Dunn (1954), on the basis of his own field experience, notes in the literature, and retinal studies by Wall, concluded that snakes of the genus *Micrurus* are "crepuscular if not nocturnal," although sometimes active in daylight.

It is clear that (1) much more information is needed before generalizations can be fully supported and (2) species of the genus probably differ in their response to light. It may be, for example, that those species of regions which are dryer, hotter, or with more intense light are largely nocturnal, while those of places more moist, cooler, or with lower light intensities (all of which characterize the cloud forest of Rancho Grande) may be active throughout, or in any part of, the 24-hour diel period. Quite probably, individuals may have rather precise thresholds of response to these environmental factors, which would allow individuals of the same species to be more or less diurnal in certain regions but not in others, and even the same individual to be active in daylight in certain seasons or on particular days, though nocturnal most of the time.

The evolution of the striking coloration of coral snakes has been considered recently by Dunn (1954), Brattstrom (1955), Hecht and Marien (1956), and Mertens (1956b; 1957), mostly on theoretical bases because so little information is available on their behavior and ecology, both under natural conditions and experimentally. The last three authors have given the question especially careful attention and come to the same conclusion, that the bright ringed pattern has evolved under the influence of its selective value as a warning to animals which might harm it. Mertens points out that the warned animal's reaction may result from learning by the individual or be instinctive. It appears to Test and Heatwole, as it did to Hecht and Marien, that Brattstrom's suggestion of a camouflaging effect of the rings is not impossible, nor in conflict with the probable value of the coloration as a warning. Indeed, a camouflage value might increase the selective advantage of the pattern, functioning most effectively at night or in twilight, while the warning influence might have its major effect on many predators in the higher light intensities and when the snake was moving.

We believe that insufficient attention has been given to the coral snake's manipulation of its tail, which Mertens (1956*a*) mentioned briefly for *M. frontalis* and which he illustrated in all three papers (in color in that for 1957). He said that a captive, like many freshly captured coral snakes of the genus *Micrurus* which he observed at the Butantan Institute, São Paulo, Brazil, would raise its tail in the air at the slightest provocation. Thus, he pointed out, the tail simulated the head prepared for action, while the head of his captive was never lifted. This behavior, he believed, would frighten an enemy and allow the coral snake to escape more easily.

We made some observations on an individual specimen of *M. mipartitus* captured in 1951 and another in 1956. When pinned down, or held by long forceps, each snake raised its tail and waved it about, the tip curled into a knot in such a manner that it roughly resembled the head in shape, size, and

coloration. (This species has only black and white bands alternating with each other on the body, but on the black head is a broad pinkish red band, and on the stubby tail are 2 to 5 of the same color.) The waving was interrupted at intervals by striking movements of the tail which were sudden, fast, and direct, though not directed. During these actions of the tail, the head was hidden under leaf litter and other loose objects as the snake tried to crawl away. At times the tail uncurled and was lowered to the ground, where it traveled slowly backward, resembling forward motion of the anterior part of the body. When observing this behavior, even *Homo sapiens* is confused, especially by the rapid movements of the tail. It was only after persistent and severe molestation that these snakes resorted to biting.

One, taken December 7, 1951, did not strike once with its head while being captured, even though it was held down strongly by sticks. At the first disturbance it formed a head-simulating curl of the tail, and it lashed and writhed so rapidly and violently that, most of the time, we could not be sure which end was head. When placed on leaf litter in a jar in the laboratory it coiled with its head hidden and its tail exposed against the side of the jar and on the outside of its coiled body.

These actions by the snake are all such as to attract attention to its tail, while the head is hidden. Casual experiments on humans show that they are confused as to which end is head. The confusion is heightened by the particular coloration of *M. mipartitus,* with red on the head and tail only. Mertens' published photograph in color shows that in *M. frontalis* as well, the simulating tail closely approximates the head in coloration. The black tip is curled tight on itself, and the whole tail is bent into a J which places the yellow band at the curve and thus in a forward position as the tail strikes. "Behind" it, on each arm of the J is a narrow black area, and next to this a broad red one. This is the same sequence as in the head, where the snout is yellow, followed posteriorly by a narrow black region, then a broad red band.

In a specimen of *M. mipartitus* which we photographed in motion pictures, the ventrally flattened basal part of the tail curved up from the ground to raise the red bands a few inches above the substrate. The simulation of color pattern of the head was achieved (Fig. 2) by the red-banded part of the tail curving to the left to form a single large circle situated almost symmetrically at the end of the vertical part and roughly parallel to the ground. Red bands (counting from anterior to posterior) 2, 1, and 4 lay in that order from left to right across the front part of the circle, with red band 3 forming the back. The black band across the back of the head was simulated by three black bands of the tail lining up almost perfectly across the red circle. The black band following red band 1 extended forward at

right angles to this line, simulating the black snout of the snake, but was not as conspicuous. Thus, one specimen each of *M. frontalis* and *M. mipartitus* used different methods of simulation, which were related to their different color patterns. Whether the method is uniform within each species is not known.

Such behavior, including the simulation in coloration, confusing humans as it does, could be expected to confuse other predators as well, although no observations on this are known to us. The sensitivity of birds, including predators, to red has been pointed out by Hecht and Marien and

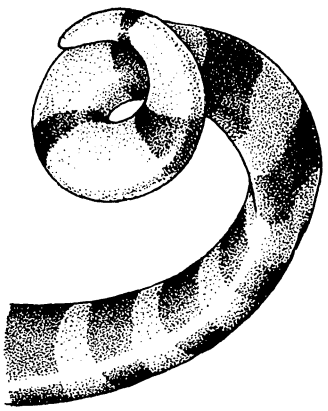

FIG. 2. Tail of *Micrurus mipartitus semipartitus* simulating head. The end of the tail is raised above the ground and curled to form a color pattern similar to that of the head, which has the snout and occiput black and a broad pinkish red band across the middle. The last four pale bands of the tail are red. Except for head and tail the snake is banded black and white. (Drawn from motion picture film.)

by Mertens. Thus, the attention of avian predators would probably be attracted to the rapidly moving spots of red of *M. mipartitus* or the red and bright yellow of *M. frontalis,* while the head is hidden under debris. The greater size of the simulated head would doubtless enhance this attraction. With a large proportion, at least, of blows or crushing bites, usually delivered by a predator to the head, falling instead on the relatively unimportant tail, the snake would have more time in which to escape under the debris, and become completely hidden from the predator, with only minor damage having resulted. Further, if the snake did not escape immediately and was carried away by the bird, it would still have considerable time in which to free itself by struggle or by accident. Even if only a small proportion of snakes actually escape by this means, the selective effect would be felt. Because

their feathers are non-living and stand out so far from their bodies, and because of their movements, predatory birds are notoriously difficult for even rattlesnakes (*Crotalus*) to bite effectively.

We believe that the simulation of head by the tail may have played an important role in directing or allowing evolutionary establishment of the conspicuous pattern in *Micrurus*. If three selective advantages (camouflage, warning, diversion) operated, the evolutionary fixing of this pattern must have been both rapid and sure. We do not know whether this diversionary behavior occurs in the mimics of species of *Micrurus*.

Of our nine specimens, seven have three pink bands on the tail, one has two, and another has four. One has a small black spot in the center of the pink band across the head, a variation not mentioned by Roze (1955).

Micrurus isozonus (Cope).—The only one found was alive, but injured, near Guamitas on the road between Maracay and Rancho Grande at an elevation of about 650 m., May 19, 1960. It had been crossing from a narrow brushy gully toward a slope covered with savanna-like vegetation. Although Roze (1955) lists a specimen from Rancho Grande, it is possible that it was not collected in cloud forest.

Family Viperidae

Bothrops atrox (Linnaeus).—As Sandner's description (1961) of *B. venezuelae* was published after our last trip to Venezuela, we were not able to look for ecological differences between it and *atrox* in the field. One of us (FHT), however, in 1951–52 recognized two color types in the *Bothrops* at Rancho Grande. One was brown and light tan dorsally with widely spaced brown marks; the other was brown and black with the black areas rather closely spaced. These apparently correspond, respectively, to *atrox* and *venezuelae* as Sandner recognized them.

Sexton collected a considerable number of specimens of *Bothrops* at Rancho Grande in 1956 and, on the basis of scale counts, could not separate out two distinct groups.

Sandner too found scale counts which were largely mutually inclusive. His descriptions of coloration give a better basis for separation, though they are not completely applicable to specimens which have been preserved for several years. Perhaps his most striking evidence (Garcia and Sandner, 1962) is the wide difference, both qualitative and quantitative, in certain physiological properties between the venoms of *B. atrox* and *venezuelae*. However, as the range of variation within each species is not shown, the validity of two species is not clear from the data given.

Fourteen of our 30 specimens of *Bothrops* we have identified as *atrox*, largely on the basis of coloration and shape of snout. Scale counts show much

overlapping (Table 6) with those of specimens we have identified as *venezuelae* on the same basis. The scale counts published by Garcia and Sandner (1962) also show a great deal of overlap. Average scale counts for our specimens are somewhat different in the two groups but not greatly so. The largest difference in scalation is in the number of caudals, of which only four counts are more than 58 in our *"atrox,"* while only two of the *"venezuelae"* have counts of less than 60. Most of our scale counts are similar to those of Garcia and Sandner. Those for dorsal scale rows and caudals of *venezuelae* extend their numbers slightly at the upper end, and our counts of the frontals between the eyes are considerably lower than theirs. This last measurement, however, is so affected by subjective decision, because of great variation in size and position of scales, that it is of questionable value.

TABLE 6
SCALE COUNTS OF *Bothrops atrox* AND *B. venezuelae*
(Averages in parentheses)

Snakes	Dorsals	Ventrals	Caudals	Frontals between the eyes
14 specimens of *B. atrox* in our collections	23–27 (24.5)	193–217 (199.5)	51–73 (59.8)	5–9 (7.1)
Counts reported by Garcia and Sandner for *atrox*	21–33	180–240	75 or less	5–10
13 specimens of *venezuelae* in our collections	20–27 (23.7)	191–202 (195.1)	58–66 (62.3)	5–7 (5.8)
Counts reported by Garcia and Sandner for *venezuelae*	19–25	< 204	< 64	14–18

Shape of snout and coloration, as described for *B. venezuelae* by Garcia and Sandner, agree in all our specimens but one. In those we have identified as *atrox,* the snout shape of three looks more like that of *venezuelae.* Three specimens show mixtures and intermediacy of characteristics.

On the basis of our identifications, no clear ecologic segregation is apparent between the two forms. Both occur along the streams in the vicinity of Rancho Grande, and the senior author once saw two individuals of *atrox* and one of *venezuelae* (judged by coloration) along a small stream within 5 m. These were young. One *atrox* was on a sapling about 2.5 m. above and overhanging the stream. None of our large specimens from Rancho Grande is *atrox,* whereas an adult killed by a road crew in the hot dry valley above Las Delicias did represent this form. There are no indications from our specimens that the proportions of the two forms in the Rancho Grande population differ through the year.

A paper by Sexton (1958), based on observations in the summer of 1956, showed that young individuals (of both forms, although *venezuelae* was not recognized at that time) were most often found in the vicinity of streams, where they fed on small frogs, whereas the larger ones were usually away from the water and fed on small mammals.

Observations by Test in the other months of the year indicated the same distributional pattern (species usually not identified). Young were often seen in the daytime coiled at the edge of the stream, sometimes partly in the water. On a series of 11 trips at approximately weekly intervals between September 30 and December 22, 1951, made along the same 200 m. of stream in a deep ravine on the south side of Pico Periquito, a total of 10 individuals of *Bothrops* was seen. One trip produced three within 5 m., and on four trips none was seen. Five trips resulted in one each. All of these snakes were less than 1 m. long. The route was directly along the stream, which varied from 0.5 to 2 m. wide, and the observer moved slowly, keeping close watch for *Bothrops*. Even so, experience with some individuals indicated that others may have been overlooked.

All individuals observed, except one, were coiled and inactive when found, and most remained so, unless touched, even though the person approached within a meter or less. Ink was dripped on the heads of some, in an attempt at marking, without disturbing them. The relatively low temperatures in the cloud forest may have been, at least in part, responsible for this lack of irritability. Only one snake moved away about 0.5 m. when approach was made to within 0.5 m. Accidentally stepping within 25 cm. of the face of an individual did not cause movement. The young one on the sapling jumped or fell as a person was walking beneath, perhaps stimulated by a camera tripod being carried over his shoulder.

Bothrops venezuelae Sandner.—On the basis of coloration, 13 of our 30 specimens from Rancho Grande are identified as *Bothrops venezuelae*. In 12 of the 13, the snout shape too is judged to be that of *venezuelae*. All of our specimens of *venezuelae* (Table 6) have scale counts for rows of frontal scales between the eyes which fall below the range given by Garcia and Sandner (1962). Our counts of dorsal scale rows and caudals extend slightly higher than their figures.

All of the three large individuals of *Bothrops* collected in the Rancho Grande cloud forest had the *venezuelae* pattern of coloration; at least two other large ones of this type were seen but not obtained. This, together with the data given under *atrox*, suggests that *venezuelae* may find its optimum in the cloud forest, and *atrox* in warmer, dryer places but with a great deal of mixing, especially of the young, around the lower limits of cloud forest.

Three snakes, all large, with the *venezuelae* pattern were 1.5–2 m. above

the ground in the forest when found. Two were coiled on strong, spreading ferns in daytime, and the third was on a horizontal branch of a bushy tree, over a stream at night. *B. venezuelae* may be somewhat more arboreal than *atrox*.

A large individual (UMMZ 124259) found December 18, 1951, at about 1250 m. beside the trail up Pico Periquito, had probably recently given birth to young. Her anus was agape and the belly wall flaccid. She was 200 m. or more from a stream.

The only individual of *Bothrops* which was clearly moving when found was a large one of this form which slowly crossed a footpath through cloud forest on April 12, 1960, in daylight though under an overcast sky.

It is apparent that much additional information is needed on *Bothrops atrox* and *B. venezuelae* in northern Venezuela and that further study should yield interesting results.

Order Crocodilia

Family Crocodylidae

Caiman sclerops (Schneider).—The "baba" is said to be common in Lake Valencia, and we have seen individuals along the marshy shore of the peninsula, which lies west of Maracay, and on Zorro Island. No specimens were obtained by us, but we have seen a number collected by others.

DISCUSSION

The total of 42 species (Table 7) here recorded by us comprises one turtle, 19 lizards, 21 snakes, and a single crocodilian. The majority of these are lowland species, but there are 6 lizards (counting *Gonatodes taniae* and *Pseudogonatodes lunulatus)* and 13 or 14 snakes which occur in the cloud forest. The fourteenth species, *Dipsas latifrontalis,* is of doubtful inclusion because it was found there only in the non-rainy season, and along the road, suggesting that it may enter cloud forest only where conditions are made warmer and dryer by modification and when food becomes scarce in the non-rainy season. However, J. A. Peters (1960) recorded this species from higher altitudes in Ecuador.

The proportional reductions in number of species from lower zones to cloud forest indicate that lizards, as a group, are less tolerant of cloud forest conditions than are snakes. Martin (1955) too concluded that cloud forest was not a favorable environment for reptiles. His analysis (1958) of records for the Gomez Farias region of Tamaulipas, Mexico, showed also that a larger proportion of snakes than lizards of the region were found in cloud forest proper.

The work on reptiles at Rancho Grande probably has not yet brought to light all species which occur even in its near vicinity. Certainly much

TABLE 7

SUMMARY OF ALTITUDINAL RECORDS OF REPTILES FOR THE RANCHO GRANDE REGION

Species	Lowland records	Records for cloud forest zone	
		In clearings or at extreme lower edge of cloud forest	Cloud forest proper
Kinosternon scorpioides	X		
Thecadactylus rapicaudus	X		
Gonatodes taniae		X	X ?
G. vittatus	X		
Pseudogonatodes lunulatus	X	X	
Anolis tigrinus		X	X ?
A. nitens	X		
A. squamatulus			X
Iguana iguana	X		
Polychrus marmoratus	X		
Tropidurus torquatus	X		
Ameiva ameiva	X		
Argalia marmorata			X
Cnemidophorus lemniscatus	X		
Euspondylus acutirostris			X
Proctoporus achlyens			X
P. luctuosus		X	
Tretioscincus bifasciatus	X		
Amphisbaena alba	X		
Mabuya mabouya		X	
Contrictor constrictor	X		
Chironius carinatus	X	X	
C. monticola			X
Clelia cloelia	X		
Dendrophidion percarinatum	X	X	X
Dryadophis boddaertii			X
Imantodes cenchoa			X
Leimadophis melanotus	X		
L. zweifeli		X	X
Leptodeira annulata	X		
Ninia atrata	X		X
Oxyrhopus petola			X
Umbrivaga mertensi		X	
Urotheca lateristriga			X
U. williamsi			X
Dipsas latifrontalis			X
D. variegata			X
Micrurus mipartitus			X
M. isozonus	X		
Bothrops atrox	X	X	X
B. venezuelae			X
Caiman sclerops	X		

remains to be discovered of their life histories and ecology. Distributional patterns need further study and are of particular interest because of the ecological mosaic near the Biological Station. Very little is known about the relative abundance of species there, and a paper by Test and Roze (MS) indicates that records from ordinary collecting methods may give erroneous indications. They found, from records of snakes killed on the road past Rancho Grande, that *Dipsas latifrontalis, Urotheca lateristriga, U. williamsi, Imantodes cenchoa,* and *Ninia atrata* are probably much more common than field observations show. On the other hand, the data from road kills suggest that *Bothrops atrox* and *B. venezuelae, Micrurus mipartitus,* and *Dendrophidion percarinatum* may be easily found in the field, in the proper microhabitat, and hence are not as common relative to other species as our numerous records indicate. *Umbrivaga mertensi, Clelia cloelia,* and *Sibon nebulatus* were not found dead on the road and were represented by only one to three specimens from our field collecting; they probably are truly uncommon. The other species of snakes listed in this paper are indicated by the road study to be about as common, relatively, as our field records indicate. Except for the few data given here for young of *Bothrops* spp., practically nothing is known of actual densities.

Unfortunately, lizards were poorly represented in the study of road kills, so we have no comparative data for checking the adequacy of our field records on numbers.

Several pairs of reptilian species of the same genus show evidence of altitudinal replacement, with only one of each pair found at Rancho Grande. If the altitudinal ranges meet, or overlap, they do so below Rancho Grande. These are (lower altitude form named first): *Gonatodes vittatus* vs. *G. taniae, Anolis nitens* vs. *A. squamatulus, Leimadophis melanotus* vs. *L. zweifeli. Micrurus isozonus* and *M. mipartitus* may also belong to this category, but the evidence is not clear. Roze's published data (1955) shows that the two latter species overlap altitudinally and that both occur at Caracas and Rancho Grande. It is not indicated, however, whether they occur in the same kinds of places; they may be separated ecologically. As six of his records of *M. mipartitus* and only one of *M. isozonus* are for Rancho Grande, the former is indicated as the common species of the cloud forest, as indeed we found it. His Rancho Grande record of *M. isozonus* may refer to a specimen which was actually taken a short distance below and in a lower biotic zone, though labeled Rancho Grande because it was the nearest named place. Roze's other localities for *M. isozonus,* in fact, are mostly from lower altitudes and/or dryer regions. The highest altitude record, Los Venados at 1400 m., is dryer than Rancho Grande, being on the south side of the high mountains between Caracas and the coast, and not in cloud forest.

Four other pairs of species we found to occur together at Rancho Grande. *Proctoporus achlyens* is the common form of the cloud forest, and *P. luctuosus* was found only in and around the Station building, suggesting that it has reached this place only because of man's activity in keeping a warm, dry area of some size and a corridor (the road) from the lowlands to it. *Chironius monticola* and *C. carinatus* were both found along the road, and our records show no ecologic segregation in the Rancho Grande area. Our only forest record was of a very large *C. carinatus* just within the lower border of cloud forest. This species is known to be common at lower elevations, whereas Roze has described *C. monticola* as a mountain form. *Dipsas latifrontalis* and *D. variegatus* are known to us only from specimens found along the road, mostly dead. The restriction of our records of *D. latifrontalis* to the latter part of the non-rainy season suggests that it occurs mainly in the zone below the cloud forest; individuals perhaps move into nearby cloud forest for food (snails) as they have more difficulty in finding it in the dry zone. According to J. A. Peters (1960), the type came from an altitude of 1000 m. in the Andean state of Mérida. He records specimens from altitudes of 800–1100 m. in Ecuador.

Urotheca lateristriga multilineata and *U. williamsi* were found dead on the road through cloud forest near Portachuelo Pass and certainly occur together there, for the collection dates range through the latter part of the non-rainy season and to the peak of the rainy season for both species. One individual of *U. williamsi* was unknowingly stepped on, under dead leaves, well within the cloud forest. In the paper where he described this species, Roze (1958) stated its altitudinal range to be 1000–2000 m., "in cloud forest."

Bothrops venezuelae and *B. atrox* clearly overlap in the Rancho Grande region, even ecologically. Although we have some slight evidence that the optimum altitude for *venezuelae* may be higher than that for *atrox,* the whole problem of the relationships between these forms clearly needs further study. In fact, comparative studies of all the pairs of species named above, both allopatric and sympatric, should be rewarding in ecological and evolutionary data.

In a region such as the Rancho Grande cloud forest, with so little variation in temperature, moisture of air and litter, daily length of photoperiod, and plant canopy throughout the year, the period of reproduction of organisms becomes of special interest. Our information is not extensive, but so little is known about organisms of the cloud forest that our data are worth summarizing.

Our most extensive knowledge is on the two lizards, *Proctoporus achlyens* and *Gonatodes taniae,* both confined to the cloud forest region in our experience. The former occurs in damp litter, the latter on rock outcrops.

The evidence indicates that, as a species, *Proctoporus achlyens* deposits eggs the year around, with the possible exception of the very end (March) of the non-rainy season. We have no knowledge of time of mating, though in a species which deposits eggs throughout the year, we judge it most probable that the interval between mating and egg deposition is short. The finding of considerably more small young in December than any other month suggests that more females lay their eggs in the waning part (October) of the rainy season than at any other time.

In contrast, for *Gonatodes taniae* the waning part (August–November) of the rainy season constitutes the four months for which we have no evidence of egg deposition. Our data for this species are fewer than for *Proctoporus achlyens.*

Our information on reproductive dates in other species is very fragmentary. Behavior of three adults of *Mabuya mabouya* in the early part of the non-rainy season (January 23) suggested precopulatory activity. Five species of snakes (*Chironius carinatus, Dendrophidion percarinatum, Leimadophis zweifeli, Oxyrhopus petola, Dipsas variegata*) together showed strong evidence for egg deposition in months ranging from April to November, thus approximately spanning the rainy season, but there is no indication whether any one species spans it. For four species (*Dendrophidion percarinatum, Leimadophis zweifeli, Oxyrhopus petola*, and *Bothrops venezuelae*) hatching dates in the waning part of the rainy season (September-December) are indicated. If a period of approximately four months is needed for incubation, then their mating and egg deposition (in the oviparous forms) probably occurred in the first part and middle of the rainy season. Test and Roze (MS) have shown that snakes become either more active or more abundant at Rancho Grande in the early part of the rainy season, and the data in this paper suggest that such a change may result from increased activity related to breeding. Our data show no indication that it is the result of recent natality.

Comparison may profitably be made of the reptilian fauna found by us in the Rancho Grande region with that recorded by Ruthven (1922) for the Santa Marta Mountains. This range, smaller than the Cordillera de la Costa of Venezuela, lies on the north coast of Colombia, west of the western arm of the main range of the Andes and separated from it by low altitudes, as the Cordillera de la Costa is from the eastern arm of the Andes proper. Between the two arms of the Andes lies the large and very low Maracaibo basin.

Fifteen of the 42 species recorded by us from the Rancho Grande region were in Ruthven's list; half of them were lizards. Ruthven's total list included 27 species of lizards, 32 of snakes, two crocodilians, and two turtles, a much larger one than ours. Much of the difference in size probably results from the larger area covered by Ruthven's list as well as from the much more extensive

and intensive collecting by his party. Our collecting of reptiles was largely incidental, and we did most of our field work in the cloud forest, which one would expect to have fewer reptiles than the lower, warmer areas.

In cloud forest, Ruthven recorded two species of lizards and nine of snakes, whereas we found six of lizards (including *Pseudogonatodes lunulatus)* and 13 or 14 of snakes. This reversal of the difference noted in the previous paragraph can be attributed, at least in part, to our concentration of effort in cloud forest. Another influencing factor may be extension of cloud forest to lower limits (700 m. on the coastal side) at Rancho Grande than in the Santa Marta Mountains (1300 m.) where lower temperatures would be expected to be less suitable for reptiles. Only three of the species we found occurred also in Santa Marta cloud forest: *Dryadophis boddaertii, Leimadophis melanotus,* and *Micrurus mipartitus.* Of these, *Leimadophis melanotus* was recorded by us only in the low country, being replaced in cloud forest by *Leimadophis zweifeli.* The small amount of similarity in the reptilian faunas of the cloud forests of the two regions indicates the strong effect of time, distance, and warmer and dryer intervening areas in isolating them from each other.

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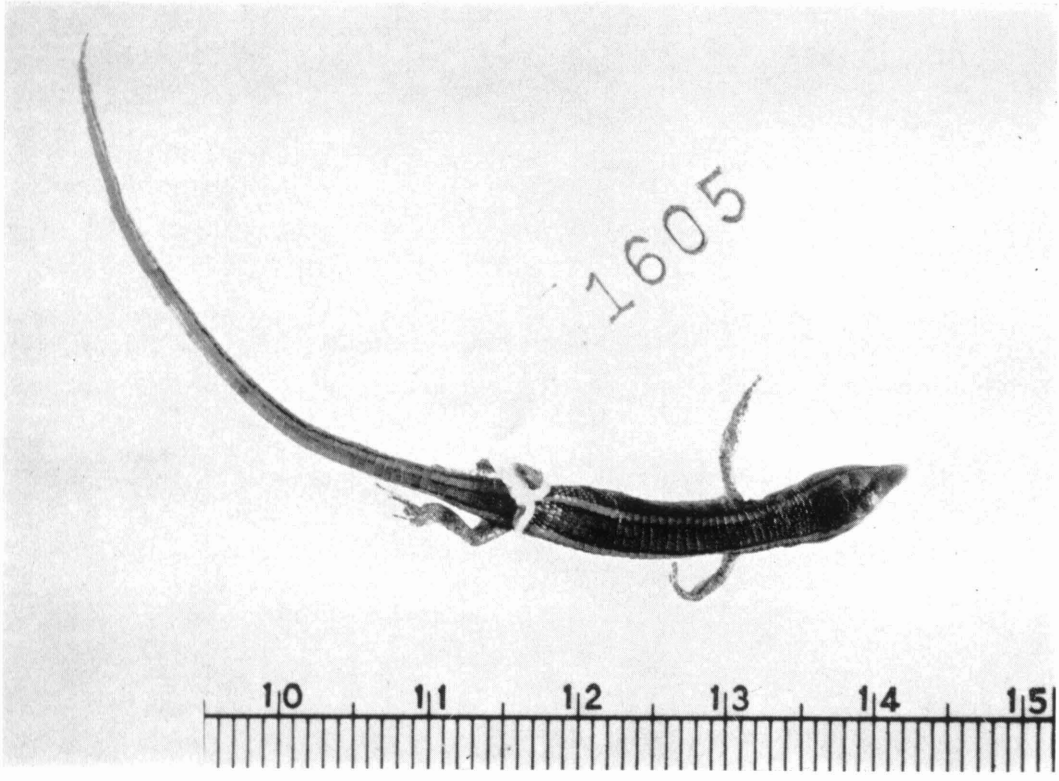
PLATE I

UPPER: Mass of humus and leaf litter opened to show clutch of eggs of *Proctoporus achlyens* at base of bromeliad epiphytic on a fallen limb.

LOWER: Interior of cloud forest, looking downslope, near Portachuelo Pass, Rancho Grande. Readily seen are palms of three species, melostomes with prominently veined leaves at left and lower right, bryophytes epiphytic on tree trunks, a stilt palm (background) with a large-leaved *Philodendron* climbing it, and other ground and epiphytic species. The thin leaf litter on the ground and fallen rotting branch are also visible. No artificial clearing has been done here, but the fallen branch may have reduced somewhat the vegetation between camera and stilt palm.

PLATE II

Photograph of preserved female *Euspondylus acutirostris* (UMMZ 125769). Dorsal view (approx. × 2).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