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## HERPETOLOGY.-Miscellaneous notes on Mexican lizards. ${ }^{1}$ Нobart M. Smith, University of Illinois. (Communicated by Herbert Friedmann.)

For a number of years I have been accumulating notes on lizards of Mexico for use in a report upon the collections secured from 1938 to 1940 by my wife and me during my tenure of the Walter Rathbone Bacon Traveling Scholarship of the Smithsonian Institution. Preparation of a checklist of Mexican lizards prior to completion of this report requires preliminary publication of certain portions of these notes.

Unless otherwise stated, the specimens cited in the following pages are part of the collections mentioned previously, now part of the U. S. National Museum collection, to which the numbers refer. Other abbreviations are: EHT-HMS, the Taylor-Smith collection, at the University of Kansas; CNHM, Chicago Natural History Museum.

I am indebted to Dr. Edward H. Taylor, Dr. Doris M. Cochran, Karl P. Schmidt, and Dr. L. C. Stuart for numerous courtesies contributing to the collection and study of the material here reported.

## Sphaerodactylus glaucus glaucus Cope

One hundred and sixteen typical specimens (see below) were secured at the following localities: Veracruz: Tezonapa (no. 113086). TAbasco: Âlvaro Obregón (Frontera) (nos. 113096120); Emiliano Zapata (Montecristo) (no. 113095); Tenosique (nos. 113087-94). Guatemala: Piedras Negras, Petén (nos. 113084-5).

All except a few from Piedras Negras were caught in towns, under loose bark of trees or in houses. On May 13, 1939, large quantities of eggs nearly ready to hatch, as well as adults, were found under the loose flakes of bark on trees in the central park of Âlvaro Obregón. Many of the eggs that were retained hatched within a day or two. Generally two eggs were found in a clutch, although sometimes as many as six or

[^0]eight, presumably from several females, were found in a single spot. The eggs were nearly perfect spheres and were protected by a very brittle shell.

The adults of the east-coast race of this species are characterized by generally having a small black spot middorsally on the neck; a black spot on each side of rump, above insertion of hind leg, each bordered posteriorly by a light spot; a light spot on knees and sometimes elbows; a distinct, light band across distal portion of thighs and lower foreleg; and a distinct light line on posterior surface of thigh, extending onto base of tail.

Young specimens are similarly marked, although a little darker and with numerous very tiny white flecks scattered over the back. The only great difference from the adults in markings is in the neck region. A series of small rounded light spots encircles the dorsal and lateral surfaces of the neck a short distance in front of the arm insertion; the two most prominent spots are those on each side of the middorsal line. Surrounding the spots is an irregular band of black; its most prominent portion is a spot between and slightly anterior to the larger, paravertebral light spots. Specimens of larger size lose all these neck markings save the median dark spot.

A series of atypical specimens is available from various localities near Tehuantepec (La Presa de Mixtequilla, Cerro Guengola, Cajón de Piedra) as weli as from the city itself (nos. 113139-63). These differ from typical glaucus by lacking any distinct light and dark marks in the adult; even the very young show no distinct markings. These might be considered racially distinct from g. glaucus, except for two adult specimens which possess an irregular, black, double collar about the neck. These definitely link the Tehuantepec series with the west-coast race torquatus, typical specimens of which are available from more remote localities on the Isthmus toward the coast west of Salina Cruz. The latter race also is
characterized by absence of the distinctive markings of $g$. glaucus, but adds a new character in the possession of two broad, distinct black collars about the neck. In the area in which they occur on the Isthmus, on the coast southwest of Tehuantepec, they exist to the almost total exclusion of the unicolor type which occurs around Tehuantepec city; in fact only two specimens of the latter were said to be collected with the collared specimens. Since the collared specimens possibly range rather widely on the Pacific coast northwest of the Isthmus, as indicated by the type locality of torquatus at "Mazatlán" (Sinaloa?); and since the unicolored or typical glaucus type of pattern rarely if ever occurs with the collared specimens, there is ample reason to hold the latter as racially distinct from the others. In fact, Taylor (Univ. Kansas Sci. Bull. 31: 302305. 1947) has already demonstrated the distinctness of torquatus.

The unicolored specimens from the vicinity of Tehuantepec are, I believe, essentially intergrades between typical glaucus and $g$. torquatus; certainly they are intermediate both geographically and in pattern; they lack the characteristic collar of torquatus, yet like it are practically unicolored otherwise, contrary to glaucus which has distinct leg and neck markings. If Peters's inornatus from "Mexico" actually belongs to glaucus and is not a lineolatus with incorrect locality data as suggested by Barbour (Mem. Mus. Comp. Zool. 48: 240. 1921), it may be based on the unicolored intergrades between g. glaucus and $g$. torquatus, from the vicinity of Tehuantepec.

The U. S. National Museum has 20 others, as follows: Campeche: Apazote (no. 47796). OAxaca: Juchitán (nos. 30235-8). Tabasco: Âlvaro Obregón (nos. 37749-51, 46694, 81166). Veracruz: Coatzacoalcos River (nos. 61184-5); Tuxpan (no. 25215). Yucatán: Mérida (nos. 6572, 62995-6); Cozumel Island (no. 47644). Indefinite: "Mexico" (nos. 96108-10).

Sphaerodactylus glaucus torquatus Strauch
Twelve specimens are from Cajón de Piedra (nos. 113126-33) and El Limón (no. 113134), Oaxaca. Both localities are near the coast west of Salina Cruz.

## Corythophanes percarinatus Duméril

A single specimen (no. 113171) is from Colonia Hidalgo, 8 kilometers north of La Esperanza, Chiapas. It differs from a single specimen avail-
able from "Guatemala" (no. 25217) by having a blunter snout, smaller temporals, head scales less strongly keeled posteriorly, and scales on shank and thigh much smaller. Further specimens will be necessary to show whether these differences are due to individual variation; that they might have little significance is shown by considerable individual variation in cristatus, in which the temporal, thigh and shank scales vary considerably in size.

The species has not previously been recorded from Mexico.

## Ctenosaura similis (Gray)

Thirty-eight specimens were secured, at the following localities: Chiapas: Palenque (nos. 115310-7); Tonalá (nos. 115318-30); La Esperanza (nos. 115331-3). Tabasco: Tenosique (nos. 115306-9).

These specimens agree sufficiently well with the characters described by Bailey (Proc. U. S. Nat. Mus. 73 (12): 32-37, pls. 16-20. 1928) for this very distinct species. In addition to his observations it may be noted that in females the dark bands so characteristic of males are broken and frequently so dim as to be scarcely discernible. The pattern in these usually consists of numerous, scattered, short black lines. The head is mostly light in males as a rule, but regularly in females and rarely in males also the head is largely dark.

There are very obvious differences between the skulls of similis and those of acanthura and pectinata.

Other Mexican specimens in the U. S. National Museum number 34. They are from the following localities: Veracruz: Mirador (no. 6403). Yucatán: Merida (nos. 8220-1); Chichen-Itzá (nos. 47794, 47953-5, 47992-3); La Vega (no. 47564; Puerto Morelos (no. 47647); Mujeres Island (nos. 47559-63); Cozumel Island (nos. 13897-13900, 47565) "Yucatán" (nos. 24724-5, 24898). Chiapas: Palenque (no. 47593); Tonalá (nos. 46685, 46693). Tabasco: Montecristo (Emiliano Zapata) (nos. 47793, 47802). Indefinite: "Mexico" (nos. 11002-3); "Tehuantepec" (nos. 10286, 56782, 58499). Some of these were not listed by Bailey (op. cit.); others were associated with the wrong numbers, and the one from "Mirador," Veracruz, was associated by him with acanthura. It is definitely not the latter, since the tail spines are smaller, no two whorls of spines are separated from each other by a single row of small scales, the sides are barred
(juvenile female), and the distance from pineal spot to posterior margin of head is short. It is not necessarily certain that the specimen came from Mirador, but at least the existence of similis in the region of central Veracruz is demonstrated by adults from Tierra Colorada, near the city of Veracruz (EHT-HMS collection, see Smith, Kans. Univ. Sci. Bull., 22: 139-140. 1935). The specimens labelled "Tehuantepec" (Dr. Spear and J. Hurter) do not necessarily imply the city of Tehuantepec, where the species apparently does not occur, but rather the Isthmus.

## Ctenosaura acanthura (Shaw)

Only four specimens were secured, at Hda. La Clementina, 4 miles west of Forlón, Tamaulipas (no. 115259) and 10 miles east of San Juan de la Punta, Veracruz (no. 115260).

The museum has 27 other specimens, as follows: Tamaulipas: Tampico (nos. 36261-4, 36408, 36628, 36672, 36862-5, 37008, 37356). Veracruz: Panuco River, 80 miles above Tampico (nos. 26316, 26323, 26340-1); between Tampico and Veracruz (nos. 82181-3). Oaxaca: Dondominguillo (no. 72737). Indefinite: "Mexico" (nos. 42145-6, 42842, 44179, 82184); "Tehuantepec" (no. 58498). Some of these were listed by Bailey (op.cit.); the others were omitted. However, Bailey included, in his list of acanthura, one similis from Veracruz (no. 6403) and several pectinata (sensu lato) from Isabel Island and the Tres Marías Islands, and from the states of Guerrero, Oaxaca, and Michoacán. The specimen labeled "Tehuantepec" (J. Hurter) almost certainly does not refer to Tehuantepec City, where intensive collecting in recent years has failed to verify its existence in the region, but rather to the Isthmus.

Why several west-coast pectinata were included by Bailey in acanthura is not readily apparent. Not a single one can be referred to that species; none of the adults are black; none have large spines on the tail; and none have the small scales between any pair of whorls of large scales reduced to a single row at any point. There is no reason whatever to believe that acanthura occurs on the Pacific coast, so far as indicated by specimens now in the National Museum. The species appears to be perfectly well defined and restricted to the Atlantic coast from the Isthmus of Tehuantepec north to central Tamaulipas. It occurs in the same general area as similis, but its range appears to overlap that of no other species.

## Ctenosaura pectinata (Wiegmann)

Fifty-one specimens were secured, at the following localities: Guerrero: Acapulco (no. 115274); Cacahuamilpa (nos. 115277-82); 20 km north of Mexcala (nos. 115275-6); Tierra Colorada (nos. 115261-73). Michoacín: 4 km north of Apatzingán (nos. 115299-302); Parácuaro (no. 115298). Morelos: 5 km south of Cuernavaca (nos. 115295-7); Puente de Ixtla (nos. 115303-5). Oaxaca: Cerro Arenal (no. 115283); El Limón (no. 115294); Escurana (nos. 115292-3); San Bartolo (no. 115291); San Gerónimo Ixtepec (no. 115290); Santiago Lachiguiri; Tehuantepec (nos. 115284-9).

The Museum has 163 other specimens as follows: Sinaloa: Mazatlán (nos. 7180-3, 47956-7); Culiacán (no. 70665). Nayarit: Tres Marías Islands (nos. 14078, 72655-7); Maria Madre Island, Tres Marías (nos. 24623-30, 71634-5); Isabel Island (nos. 24631-3); Minimán (no. 51402); San Blas (nos. 51403-7, 65138, 76613-8); "Tepic" (no. 58753). Jalisco: Barranca Íbarra (nos. 18967, 18970, 19032); Guadalajara (nos. 24922-3); San Marcos (nos. 18968-9). Colima: Colima (nos. 12196, 24708-17, 2471923, 24726, 30594-603, 31484, 53670, 63702-31, 63734-68) ; Manzanillo (no. 63701); Tonila (nos. 63732-3). Michoacín: Sierra Madre (no. 12230; Uruapan (no. 10234). Guerrero: Balsas (nos. 47919-20, 58137); Tlapa (no. 46860). Morelos: 10 miles south of Cuernavaca (nos. 20168-72). Puebla: Piaxtla (no. 47729). Oaxaca: Cuicatlan (nos. 46835, 47194); Guichicovi (no. 47933); Juchitán (no. 72738); Tehuantepec (nos. 7533-4, 30430). Indefinite: "Mexico" (nos. 31286, 83330).

The various specimens from the west coast of Mexico south of Sonora variously assigned by Bailey (loc.cit.) to acanthura, brachylopha, brevirostris, parkeri, and pectinata all belong, I believe, to a single species. All the specimens in the U. S. National Museum assigned by him to these various names have been examined, and I can see no justification whatever for segregating them into so many species. That his arrangement is highly artificial and not a natural one (i.e., of true species and subspecies) is made immediately obvious by the recognition of several "species" from single localities. C. similis and acanthura may occur in the same locality, but this is the only recognized instance in which two species of the same group have overlapping ranges, and even this is doubtful because of the considerable competition. But that four species (parkeri,
pectinata, brachylopha, acanthura), all of the same group, should inhabit such restricted areas as the Tres Marías Islands, is preposterous. There are other cases of several species cited by Bailey from single localities. The reason for such segregation without regard to geography and the natural history of the subject, is apparently due to the overemphasis of certain "key" characters which were assumed not to vary but which actually do, to a considerable degree. The five anatomical categories given the rank of species are:

1. "Median row of dorsal scales interrupted at sacrum."
2. "First and second or first, second, and third whorls of spinous scales interspersed with three rows of small flat scales"
acanthura
2.' "First, second, third, fourth, and fifth whorls of spinous scales interspersed with three rows of small flat scales"
brachylapha
1.' "Median row of dorsal scales enlarged and extending from nape to tail, without interruption at sacrum."
3. "Head very short, rostrum conspicuously decurved" . ............... . brevirostris
3.' "Head normal, rostrum not conspicuously decurved."
4. "First six whorls of spinous scales of the tail separated from each other by four or more rows of small flat, smooth scales"............... parkeri
4.' "First five or six whorls of spinous scales separated from each other by three rows of smaller scales, the next five or six whorls being separated from each other by two rows of smaller, flat scales" ........ pectinata
The first division is impractical. The character is of aid in separating certain species of the genus, but in the area in question specimens show both extremes and all intermediates. In 28 specimens from Guerrero and Morelos, 8 have the series of enlarged middorsals passing over the sacral region without interruption; in the others the series is narrowly interrupted by as few as two small scales, or broadly interrupted by as many as 20 small scales. In one of five specimens from Michoacán, the series is complete in one, interrupted by 9 to 16 scales in the others. In 15 specimens from Oaxaca; the sacral series is uninterrupted in four, and interrupted by one to 14 scales in the others. The variation is such that it seems impossible to believe that this criterion has any significance. There is no correlation of the variation with other scale characters or with color.

By literal adherence to the word in the second division, no west-coast specimens could be associated with acanthura, but by the same interpretation neither could true acanthura. In the latter species the tail spines are stronger, longer, and more erect; the small scales between at least one or more pairs of whorls of enlarged spines are rarely not reduced to one row; adults and subadults (both sexes) become black by a general darkening of the whole body (not by encroachment of black upon spots that remain light, as in pectinata); and the reduction to two rows of the small scales between the whorls of enlarged scales begins with the second or third pair. Specimens agreeing with these characters are not represented in those examined from the Pacific coast, and there is good reason to believe the species does not exist there.

The third division, separating brevirostris, does not seem to me to have any support whatever even in the material assigned by Bailey to the two categories. The heads of presumed "brevirostris" specimens are in no respect whatever, so far as I can see, shorter than those of pectinata. It is true that the two cotypes superficially appear to have short heads, but the snout of one obviously has been pushed in, while the other has a partly broken skull.

The last division, segregating parkeri, is the most nearly feasible of all, but even this, I believe, has no special significance. Three paratypes cited by Bailey are from "Tres Marías, Nayarit," which means the Tres Marías Islands, where Bailey also distinguished pectinata, brachylopha, and acanthura. There is no geographic sense whatever in the existence of such a species, so very close in all characters but one to the specimens secured in the same localities, in two so very different spots-Barranca Íbarra, Jalisco (just north of Guadalajara), and on the Tres Marías Islands. The Tres Marías specimens obviously represent nothing but variations of the single species that occur on the islands, and I regard the Barranca Íbarra specimens in the same light. It is noteworthy that Bailey did not associate with the latter another specimen (U.S.N.M. no. 19032) of the same series and with the same data. It is true, however, that all of the three Barranca Íbarra specimens have parts (in most cases the extra row is reduced a few scales on each side of the middorsal row) of a fourth row intercalated between the proximal whorls of enlarged spines, while the same character is occasional in its occurrence elsewhere.

Two specimens (from Guerrero and Oaxaca) have portions of a fourth row intercalated between the basal five whorls of spines; in two others (Oaxaca, Guerrero) it occurs between the first, second, and third whorls; in two others recorded the extra row occurs only between the first and second whorls. These data indicate that the Barranca Íbarra specimens may uniformly be provided with four rows between the proximal whorls of spines, and thus deserve a name; it is also possible that the three specimens do not give a fair representation of the local variation, which may well actually be the same as elsewhere. Against the recognition of a local race at Barranca İbarra is the fact that Ctenosaura does not incline toward formation of such restricted populations. Its members otherwise have large geographic ranges representing major faunal areas.

The elimination of such a miscellany of supposed species on the Pacific coast makes very clear and reasonable the distribution of the species of Ctenosaura in Mexico. C. hemilopha occurs in Baja California and Sonora, and southward is replaced by pectinata, which occurs from central Sinaloa to the Isthmus of Tehuantepec. Beyond the Isthmus (toward Central America), on both coasts, similis occurs to the exclusion of all others of its group; it extends northward on the Atlantic coast to central Veracruz. Here it either overlaps or dovetails into the range of acanthura, which occurs from Oaxaca (Dondominguillo) northward to central Tamaulipas. The only conspicuous overlapping of ranges occurs between members of different groups; i.e., the species clarki, quinquecarinata, erythromelas, and defensor belong to quite a different group than the others; they are of different habitus, size and habits, and occur commonly over broad areas occupied by acanthura and its relatives.

## Phrynosoma boucardii (Bocourt)

One fine example is from Zimapán, Hidalgo (no. 111370). The U. S. National Museum has no others of the species.

This specimen differs from orbiculare, which it closely resembles, in the large size of the postorbital, temporal and occipital spines, the feeble keels on the gular scales, and the nearly erect position of the occipital spines. It measures 79 mm from snout to vent; the frontal region is strongly concave, the superciliary regions elevated and terminating posteriorly in a relatively large spine measuring a maximum of about 3.5 mm . The occipital spines are 5.8 mm long (maximum),
and their posterior edges make an angle of about $75^{\circ}$ with the horizontal, while the temporal spines are at an angle much less than $45^{\circ}$. The temporal spines extend farther posterior than the occipital (because of their nearly horizontal position), and the posterior measures 5.7 mm (maximum). The posterior infralabials, the postaurals and the subpostaurals are conspicuously enlarged. The gulars are feebly keeled.

## Sceloporus malachiticus acanthinus (Günther)

Thirty-one specimens are from La Esperanza, Las Nubes, Salto de Agua, Cruz de Piedra, Finca Juárez, Rancho Las Gradas, and La Magnolia, all in the vicinity of Escuintla, Chiapas (nos. 112112-40; EHT-HMS 17046-7).

The dorsals vary from 34 to 39 (except in two, noted below), average 36.7 ( 34 , two; 35 , four; 36 , eight; 37 , six; 38 , four; 39 , five); femoral pores 12 to 16 , average 13.7 ( 12 , nine; 13 , sixteen; 14 , seventeen; 15 , twelve; 16 , two) : there are two canthals, but in seven the anterior is forced above the canthal ridge; the median frontonasal is in contact with the lateral frontonasal in all except one side of one, both sides of four; one or more supraoculars are in contact with the median head scales in all except on one side of one, on both sides of another; the supraoculars are partially split (small outer scales) in one; the lorilabials are reduced to one row below the subocular on one side in three, on both sides in two; there are 3 scales (minimum) from median frontonasal to rostral in twenty, 4 in seven.

The most interesting of this series are 12 from Finca Juárez. This locality is at 2,500 to 3,000 feet in elevation, as high as or higher than any other at which acanthinus was secured. Seven of these are more or less typical of the subspecies, while the other five show so many combinations of characters of taeniocnemis and acanthinus that they must be considered intergrades. Two of them have small outer supraoculars; three have the median frontonasal separated from the lateral frontonasals on both sides, and one specimen on one side; three have four scales from the median frontonasal to the rostral and one has five; one has the aberrant count of 42 dorsals and another has 45. None of these can be considered typical taeniocnemis, although all approach the sum character of that race in a varying number of respects. I can see no alternative to the conclusion that these represent intergrades, that acanthinus and taeniocnemis intergrade, and therefore that the former must be removed from
the spinosus group and placed in the formosus group.

All specimens were found on the trunks of large trees. They were very wary and seldom seen except when we were specifically hunting them.

In addition to these are six noteworthy specimens (EHT-HMS X5020-4) from La Gloria, Oaxaca. This locality is on the east side of the Isthmus of Tehuantepec, almost directly north of Niltepec, but in the moist, high forest on the Atlantic slope, at about 1,500 feet elevation. The specimens were collected by Thomas MacDougall on dead, burned tree trunks in open cornfields recently cleared from the forest. They have 35 to 40 dorsals ( $35,36,37,40,40$ ); 10 to 13 femoral pores ( $10-10,11$-?, 11-11, 11-12, 11-12, 13-13); two canthals; median frontonasal separated from laterals; large supraoculars in a single row and not in contact with median head scales, sometimes the outer row represented by one or two small scales split from "inner" row; lorilabials in two complete rows below subocular; and 4 to 6 scales (minimum counts) from median frontonasal to rostral $(4,5,5,5,5,6)$. The only adult (a female) measures 83 mm snout to vent; the others are juveniles. The color above is gray (no trace of blue), with a row of brownish spots on either side of middorsum, each spot covering about three scales; a feebly indicated, black, dorsal nuchal collar, visible also on sides of gular region; in the adult female a faint indication of the characteristic, broad, short, dark, median borders of the lateral belly patches occurring in males of this group.

The proper allocation of the La Gloria series is not too obvious. The specimens can not be associated with taeniocnemis, since this is a highlands species with divided supraoculars, much blue in the coloration, smaller dorsals, more numerous femoral pores, and no distinct rows of large spots. They can not be associated with salvini, which also has more numerous dorsals and in addition a complete nuchal collar. Although the large supraoculars and larger dorsals are reminiscent of acanthinus, the latter race has large frontonasals in contact with each other, and the supraoculars generally in contact with the median head scales.

Because of the impossibility of association of the La Gloria specimens with typical members of other races in adjoining areas, they might be considered as representing still a different race. In support of this view are the peculiar, very small, rounded scales in the internasal area; rare speci-
mens of taeniocnemis show a similar condition, but otherwise it is unique. However, it seems more probable to me that the La Gloria specimens represent intergrades between acanthinus and salvini; they combine the characters of these two races and show no peculiarities not existing in one race or the other, except for the small internasals as previously mentioned. La Gloria is also geographically intermediate between the known ranges of the two races. Therefore, until further specimens from other localities, especially in western Chiapas (both Atlantic and Pacific slopes), indicate otherwise, it appears best to consider the La Gloria specimens as intergrades between acanthinus and salvini.

## Sceloporus malachiticus taeniocnemis Cope

Fifteen specimens (nos. 112141-54) were secured at an elevation of about 5,500 to 6,500 feet on Mount Ovando, near La Esperanza, Chiapas. The adults are greenish above, as are the acanthinus. The dorsals vary from 37 to 47 , average 41 ( 37 , one; 38 , one; 39 , three; 40 , one; 41 , three; 42 , two; 44 , two; 47 , one); the femoral pores are 11 to 15 , average 12.6 ( 11 , one; 12 , eleven; 13 , nine; 14 , two; 15 , one) ; the canthals $2-2$, the anterior forced above the canthal ridge on one side in one; the median frontonasal is in contact with the laterals on both sides of two, on one side in one; there are 3 to 5 scales from rostral to median frontonasal (3, four; 4, eight; 5 , three); one or more supraoculars are in contact with the median head scales in two; the supraoculars are in a single row on one side of three, on both sides of two; there are two complete rows of lorilabials below subocular on one side in two, on both sides in three.

The type of taeniocnemis (U.S.N.M. no. 24768, "Guatemala", collected by H. Hague) is a juvenile measuring 39 mm snout to vent, with all the outer scales missing; dorsals 40 ; femoral pores 13 or 14 ; two distinct rows of supraoculars; median head scales much subdivided; 4 scales from median frontonasal to rostral; lateral frontonasals separated from median; two complete rows of lorilabials; canthals 2-2.

Through the courtesy of Dr. L. C. Stuart I have had the privilege of examining a series of 20 specimens from Finca Samac, near Cobán, Alta Verapaz, and 3 others from the vicinity of Nebaj, El Quiche, Guatemala, all collected by him. The former series may be considered topotypic, since Hague is known to have collected in Alta Verapaz, and since the type of taeniocnemis
agrees in detail with several young from Finca Samac. I can not distinguish these specimens from those from Mount Ovando by any character which can not be attributed to the influence of adjacent forms, or which to my mind is significant. The specimens from Guatemala never have single supraoculars nor a number of other variants which occur in the Mount Ovando series; however, their existence in the latter is almost certainly due to the influence of the closely associated race acanthinus, which taeniocnemis approaches in character toward the edge of its range. The only peculiarity I have discovered by which the Mount Ovando series differs from that from Guatemala is in the reduction in the former of the lorilabials to one row at some point below the subocular. I do not believe this difference sufficiently significant or well established to warrant an attempt to split taeniocnemis; if other minor differences should be discerned, the two populations are so alike, compared with other subspecies of malachiticus, that they can not in any circumstance be considered equivalent of smaragdinus, salvini, acanthinus, etc.

Other specimens which must be referred to taeniocnemis are three from Cobán, Guatemala (C.N.H.M. 20533, 21003; A.N.S.P. 11316); one from Teopisca (between San Cristóbal and Comitán), Chiapas (U.S.N.M. no. 47503); and three from Pinobete, $8,400-8,800$ feet, Chiapas (U.S.N.M. nos. 47761-3). The race has a central distribution on the highlands to the west and north of the range of smaragdinus.

The latter subspecies includes specimens from the central plateau of Guatemala and its projections; they are characterized by small size, numerous dorsals ( 39 to 51 ), and a single canthal. Females measuring no more than 52 mm snout to vent contain young in the uteri.

## Leiolopisma assatum assatum (Cope)

Fifty-five specimens were secured, all in the state of Chiapas in the vicinity of La Esperanza (La Esperanza, Cruz de Piedra, Salto de Agua, Rancho Las Gradas, La Magnolia, nos. 11520439). The U. S. National Museum has in addition one other specimen from Huehuetán, Chiapas (no. 47758). In 52 counts, the rows of dorsals vary from 29 to 37 ( 29 , two; 30, thirty-two; 31, two; 32 , sixteen). In 49 counts, the dorsals from parietals to posterior margin of thighs are 65 to 77 , average 71.0 ( 65 , one; 66 , one; 67 , three; 68 , three; 69 , seven; 70 , six; 71 , eight; 72 , five; 73 , six; 74, four; 75, three; 76, one; 77, one).

This species was most frequently encountered on the ground in coffee groves. In the dry season, when the ground is covered with a thick layer of dry leaves and there are no low plants to obstruct vision, they were easily captured by walking slowly through the leaves and watching closely for their wriggling, scampering bodies as they scurried out from the leaves near at hand and dived under others a few feet away. It was necessary to fall on the lizards immediately as they appeared, as otherwise they hid in the leaves and were almost impossible to find.

## Leiolopisma assatum taylori Oliver

Nineteen specimens referred to this race were collected: Guerrero: Agua del Obispo (nos. 115240-1); Tierra Colorada (no. 115242). Oaxaca: Matias Romero (nos. 115243-6). Chiapas: Tonalá (nos. 115247-58). In addition the U. S. National Museum has one from "Mexico" (no. 46866) and 13 from "Tehuantepec," Oaxaca (nos. 30101-7, 30109-13, 30170).

The single specimen without definite locality data has 24 scale rows. The three from Guerrero have 26 (two) and 28; the dorsals are 69 (two) and 72 ; two have a nuchal on both sides, and one has one on only one side. The four from Matías Romero have 26 and 28 (three) scale rows; the dorsals are 68,71 and 72 (two); two have nuchals, but in one of these on one side only; the other two have no nuchals. In the thirteen from "Tehuantepec," the scale rows are 26 (two), 28 (ten) and 30 (one). In the 12 from Tonalá, the scale rows are 26 (one), 28 (six) and 30 (four); the dorsals 66 (two), 68 (one), 69 (three), 70 (one), 71 (one), 72 (one) and 73 (one); three have nuchals on both sides, one has one on one side, and the remainder (eight) have none. The closest approach to $a$. assatum, as might be expected, is shown by the southernmost specimens, from Tonalá, in which the scale row counts of $a$. assatum occur in 33 percent of the specimens. The dorsal scale counts of the two races blend over quite a large area, since even the Guerrero specimens are within the lower limits of the range of variation in typical $a$. assatum.

## Leiolopisma gemmingeri (Cope)

Sixteen specimens were secured, as follows: Oaxaca: 17 miles north of Niltepec, on south side of Sierra Madre, in pine forest at 3,500 feet elevation (nos. 115195-6); San José Manteca, 5 km from Yautepec (no. 115194); Tres Cruces (nos. 115188-93). Veracruz: Tequeyutepec
(nos. 115197-203). In addition the U. S. National Museum has four cotypes from Orizaba, Veracruz (no. 6331), one from Río Verde (Veracruz) (no. 32372), and one from an unknown locality ("Panama," J. Hurter) (no. 56976).

In 20 of these specimens (excluding no. 32372, not seen), the scale rows vary from 25 to 28 (25, one; 26, five; 27 , two; 28 , eleven); and the dorsals from 60 to 68 ( 60 , one; 61 , one; 62 , eight; 63 , two; 64, two; 65, one; 67, one; 68, three). The color pattern is constant, save that in the specimens from Tres Cruces and San José Manteca the only portion of the lateral dark stripes that is well defined is the extreme upper edge; in the others the stripe is very dark throughout most of its width.

## Leiolopisma silvicolum Taylor

The U. S. National Museum has two specimens belonging to the recently described Leiolopisma silvicolum Taylor (Copeia, 1937, no. 1: 5-7), known previously only from the type locality near San José de Gracia, Veracruz. They are no. 12092, from "Mexico," and no. 47611, from Cuicatlán, Oaxaca. Both have 30 scale rows and the limbs strongly overlapping, as do the two types. The lateral dark stripe is poorly defined posteriorly.

| Measurement | No. 12092 | No. 47611 |
| :---: | :---: | :---: |
| Snout to vent | 44.5 mm | 47.0 mm |
| Hind leg | 18.4 mm | 17.5 mm |
| Fore leg | 11.0 mm | 12.5 mm |
| Axilla to groin | 23.0 mm | 27.0 mm |
| Dorsals. | 68 | 64 |

Eumeces lynxe Wiegmann
Twenty-seven specimens were secured, at Durango, Hidalgo (nos. 113576-82); Pan de Olla, Veracruz (nos. 113583-600); and Cruz Blanca, Veracruz (no. 113601).

Four specimens (one from Hidalgo, three from Pan de Olla) have three supraoculars as is typical of the variant named furcirostris; in these, of course, the large anterior supraocular is in contact with the parietals. In 11 other specimens (2 from Hidalgo, 8 from Pan de Olla, 1 from Cruz Blanca) the largest (second) supraocular also touches the prefrontals as in furcirostris, but a small supraocular is present between the second supraocular and first superciliary. In two others (Hidalgo and Pan de Olla) the second supraocular contacts the prefrontal on one side, is narrowly separated on the other. In the remain-
ing nine, the prefrontals are broadly or narrowly separated from the second supraocular.

The U. S. National Museum has one other specimen (no. 14605) from "Mexico."

Eumeces sumichrasti (Cope)
Ten specimens are from Piedras Negras, Guatemala (nos. 113609-12), Palenque, Chiapas (nos. 113613-5), and La Esperanza, Chiapas (nos. 113616-7).

The only difference apparent between the Pacific and Atlantic coast specimens is in the longer retention by the former of the juvenile stripes. An adult from La Esperanza measuring 75.4 mm from snout to vent still retains very distinct, dark-edged light stripes, while a specimen from Piedras Negras measuring 66.5 mm . snout to vent shows no trace of the median stripe and very faint evidence of the dorsolateral light stripes.

The scale rows about the middle of the body vary from 26 to 30 (26, one; 28, two; 30, four).

The Museum has one other, the type (no. 6601), from Potrero, Veracruz.

## Cnemidophorus sackii sackii Wiegmann

Through the courtesy of Dr. Robert Mertens I have recently received two photographs of the single type of Cnemidophorus sackii Wiegmann. These were furnished through the kindness of Dr. Eisentraut, of the Zoological Museum in Berlin. He reports that the type bears the collection number 884.

Comparison of these photographs (Fig. 1) with those reproduced in Gadow's monograph (Proc. Zool. Soc. London, 1906: 277-375) reveals a remarkable similarity to some individuals of his race $C$. mexicanus balsas, and especially to specimen C of text figure 83. No other race closely approaches the type in details of pattern. It is of special interest to note the origin of specimen C; it is from Cuernavaca, Morelos, a city through which Deppe most certainly passed enroute from Mexico City to Acapulco (see Bailey, Proc. U. S. Nat. Mus. 73 (12): 5. 1928). Not unreasonably it may be supposed that the type of $C$. sackii actually was collected near Cuernavaca. Inasmuch as no more reasonable locality can be anticipated, I hereby restrict the type locality of Cnemidophorus sackii Wiegmann to Cuernavaca, Morelos.

The form recognized by Gadow as $C$. mexicanus balsas thus becomes a synonym of $C$. sackii sackii. A tentative arrangement of subspecies
each character is calculated for specimens from each of two general geographic areas in the over-all distribution of the species (sensu lato), it is possible to identify not less than 71 per cent of more than 300 specimens as to geographic origin, on the basis of any one of these discrete variables. Taken collectively, the three criteria together with certain color and pattern differences, will correctly identify the provenance of at least 85 per cent of the specimens seen in the course of this study.

In view of the highly significant association between these criteria and certain geographic populations, two races of Ambystoma macrodactylum were recognized: the typical form, A. macrodactylum macrodactylum Baird, occupying the Columbia Plateaus Province and the Northern Basin and Range Province in Washington and Oregon, and extending through the Cascade-Sierra Province from northern California to southern and western British Columbia; also a race, A. macrodactylum krausei Peters, occupying the Northern Rocky Mountains Province in Idaho and Montana, southwestern Alberta, eastern and northern British Columbia, and questionably extending east to Iowa.

In studying the relative head widths of the various samples used in this investigation, it was found that the ratio of head width to snout-vent length (hereafter called $H W / S V$ ratio) provided a useful index to proportionate head width. However, two major types of variation were at once discernible: ontogenetic and geographic. It was found that when eastern and western specimens of equal snout-vent length were compared, eastern specimens tended usually to have proportionately narrower heads (lower $H W / S V$ ratio) than did western specimens (higher $H W / S V$ ratio). Despite the fact that this difference in $H W / S V$ ratio between strictly comparable specimens provided a useful dichotomous character for discriminating between eastern and western specimens, its use was complicated by virtue of the fact that a prominent intra-population ontogenetic variation in the $H W / S V$ ratio was present simultaneously. In brief, it was not possible to distinguish between the eastern and western populations merely by stating that population " X " had an
$H W / S V$ ratio of so much or more, while population " Y " had an $H W / \mathrm{SV}$ ratio of so-and-so or less, since the ratio itself changes very drastically as the animal grows and matures beyond the post-metamorphic stage.

The $H W / S V$ ratio gradually diminishes from about 20 per cent in young, recently metamorphosed animals, to about 15 per cent in fully mature specimens, thus indicating that the head becomes progressively narrower relative to the snout-vent length as the animal grows in size.

Hence, in order to utilize dichotomously the differential in $H W / S V$ ratio which was found in comparable specimens of the eastern and western populations, it was necessary to employ some device which would distinguish between the two populations, regardless of the size of the specimen(s) involved, and thereby circumvent the intrapopulation ontogenetic trend. The simplest solution to the problem was the utilization of a formulary device, based on the independent variable (snout-vent length), which could be applied to any snout-vent length and produce a fixed mathematical value. With such a value available, a dichotomous character results, for it is then possible to say that for any given snout-vent length population " X " has an $H W / S V$ ratio (or head width) greater than the computed formulary value, while population " Y " has an $H W / S V$ ratio (or head width) less than the formulary value. Such a formula was computed for comparing raw head width measurements, and another, derivative formula was likewise developed for comparing relative head widths ( $H W / S V$ ratios). These two formulas are respectively:

$$
\begin{align*}
& (2 \log S V)^{2}-(\log S V)^{2}  \tag{1}\\
& \frac{(2 \log S V)^{2}-(\log S V)^{2}}{S V}
\end{align*}
$$

The application of the first formula to any particular snout-vent length results in a mathematical value which may be conveniently visualized as the "standard" head width for that snout-vent length. The application of the second formula to a given snout-vent length produces a value which may be considered the "standard" $H W / S V$ ratio for that snout-vent length. In eastern
specimens (A.m. krausei), the head width and the $H W / S V$ ratio are usually less than the value obtained from either of the two formulas, while in western specimens ( $A . m$. macrodactylum) the head width and the $H W / S V$ ratio tend to be higher than the formulary values. The formulas produce about the same degree of satisfactory separation of the two populations. In my original paper (op.cit.) I published a graph based on the first formula used in conjunction with 86 specimens equally divided between the eastern and western populations. That the formula is a satisfactory dichotomous device, and that the two populations have significantly different head widths when strictly comparable specimens are examined, is reflected in the fact that 61 out of the 86 specimens used ( $=71$ per cent) in preparing the graph are correctly separated by the curve computed from the formula. When this result is tested by chi-square to determine if it could have been fortuitous or resulted from a significant association between head width size and geographic origin, a chisquare value of 17.7 is obtained, indicating a highly significant association between the variable (head width) and geographic origin.

More recently, Joshua L. Baily, Jr., has reviewed my study of Ambystoma macrodactylum, with especial attention to the problem of the significance of the differences existing between the head widths of eastern and western specimens. Mr. Baily's paper includes an excellent discussion of some properties of the arithmetic mean, and of another average, the trigonometric mean, but does not appear to contribute in any way to the problem at hand. Baily states in the beginning of his paper (1948, p. 171) that he is inclined to question whether my material adequately demonstrates a real difference in head width in the salamanders under discussion, but in the conclusion of his paper ( $p .174$ ) Baily says that confirmation is given to my conclusion that Idaho specimens have narrower heads than do specimens from Oregon and Washington, subject to certain limitations.

Baily has attacked the problem of determining whether a significant head width difference exists between these two populations through the medium of comparing certain
means, and the differences between these means. His results show that there exists a significant difference between the means of the $H W / S V$ ratios of the two populations, whether the arithmetic mean or the trigonometric mean is used. However, although Baily's results confirm my original contention, his use of means to investigate the problem is open to serious question. When organisms display a strong ontogenetic variation in certain structural characters, as do these salamanders, the comparison of means based on these characters and predicated on random samples seems to me to be essentially meaningless. To have any true biological and statistical significance, such means must properly be based on equal numbers of specimens of each of the two populations or samples, for any given size class. Baily drew his data from the graph published in my original paper (loc. cit.), but it will be noted that the 43 Idaho specimens used in preparing this graph range from 41 to 59 mm in snout-vent length, while the 43 Oregon and Washington specimens vary from 40 to 68 mm , with not less than 10 out of the 43 western specimens being 60 $\mathrm{mm}^{+}$in length. As I have pointed out, the tendency in these ambystomids is to develop a proportionately narrower head as the snout-vent length increases. Hence, with 23 per cent of the Oregon-Washington sample of greater length than any available Idaho specimens (of those used in preparing the graph), means of the $H W / S V$ ratios of these two samples would be biased toward a relatively lower figure for the western (Oregon-Washington) specimens than that obtained for the eastern (Idaho) specimens, and hence the difference between these means would tend to diminish. That the difference between these means is still significant, as Baily found, is strong confirmation of the real difference in head width in these two populations. Had there been Idaho specimens in the $60-68 \mathrm{~mm}$ range, the difference would probably have been even greater, as it would likewise have been if the Oregon-Washington specimens in the 60-80 mm range had been deleted from Baily's computations; with strictly comparable numbers of specimens from each of the two samples available for each size class, the


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[^0]:    ${ }^{1}$ Received September 3, 1948.

