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By

Edward H. Taylor

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Squamation in Caecilians, with an Atlas of Scales

Edward H. Taylor*

ABSTRACT

Scales are to be found in two families of the Gymnophiona, Ichthyophiidae and Caeciliidae, while scales are completely absent in the Typhlonectidae and Scolecomorphidae. In all of the Ichthyophiidae scales are invariably present, but in the Caeciliidae a few species appear to lack them entirely and in two species scales may be present or absent in the terminal parts of the body in the same populations.

Pertinent to the differentiation of species are the characters such as size, shape and numbers of individual scales, as well as their distribution on the body. The squamulae (minute scalelike bodies covering the scales) are likewise to be considered since these also may show specific differences.

Most scales are developed in a cavity below the skinfolds; however, a number of species of the Caeciliidae have minute scales developed in the connective tissue below the skin. These are designated subdermal scales.

INTRODUCTION

The primary purpose of materials largely or completely impervious to water at or near the surface of organisms is usually for the control of osmotic water acquisition or loss. Thus in marine and fresh water aquatic forms these materials may serve as a protection against the acquisition of too large a quantity of water with or without the dissolved salts. In terrestrial forms these materials may serve to present an excessive loss of water through the surface of the body and, in the case of poikilothermous animals, a concomitant loss of body heat. It has been postulated that in the earlier history of the earth the salts in sea water may have been quantitatively less than now; that there has been a gradual increase in salinity as more and more salts have been taken into solution from the earth. There are of course opportunities for quantitative loss or gain in salinity in isolated bodies of water.

Different animals have different salt concentrations in their body fluids, and it might be argued that this relationship is an adjustment of specific protoplasms to marine or other waters as of some particular point in geologic time; or some particular body of water (as of an inland sea) whose length of existence might suffice for the evolution of protoplasms and their salt relationships.

Many invertebrate animals lack these impervious materials. Most of the early invertebrates developed special armaments of plates and scales which,

* Research Associate, Kansas University Museum of Natural History.

aside from protection from predators, served in a measure to control water intake and outgo through the body surface. These scales were subject to variation and might differ in chemical composition, shape, size, color, decoration and their disposition on the body. For the taxonomist they provide a large part of the distinguishing characters of many groups of early vertebrates. Many early forms were scaled, but in the Caudata and Salientia living today scales as such have been lost. In the living reptiles, scales of varied sorts are present and in these animals they serve taxonomy largely in distinguishing genera and species. It has been suspected that since many of the caecilians have an ability to produce scales, these scales might provide differential characters to serve taxonomy by assisting in recognition of genera and species. Unfortunately these scales are concealed below the surface of skin and folds and for adequate comparisons considerable equipment is necessary. Also, to observe them requires the removal of much skin, and the separation of many of the body folds. This tends to injure or ruin the specimen for the study of other external characters.

In making comparisons it is necessary to compare scales from animals of comparable age, and from the same general area of the body. This is necessary since observations indicate too that scales vary in character on an individual in various parts of the body and to an extent with the age of the specimen. In this work I have usually selected the dorsal area in the last segment preceding the vent (not necessarily the last fold).

METHODS

To obtain the scales it is necessary to open the fold at its posterior edge, which usually may be done by pressure of the thumb on the posterior part of the body. Bending it strongly downward will often break the skin. If this fails, a sharp pin scratched along the groove following the fold will bring about the same result. The scales will be found under the fold lying between two layers of elongate glandules that open on the surface through the skin back of the groove. Each scale usually lies in a small flattened pocket of a very thin semi-transparent tissue, but in many cases these pockets cannot be demonstrated. Thus exposed scales may be removed with a needle or pin, care being necessary to avoid shredding or scraping their surface. The scales are nearly flat when removed and when allowed to dry tend to curl up but usually remain flexible. When placed in liquid they will usually become flattened again. (However a very few species may have inflexible scales.) If placed on a glass slide and covered with glass they remain flattened. They may, however, be kept an indefinite period in the dried state. Distilled water is the most desirable liquid medium in which to examine them, as balsam or other adhesives render them much more difficult to study.

Most of the illustrations here given of the scales of individual species were made without the use of a camera. Rather, the scale was placed in an enlarger and used as a negative, its image being focused directly on the photographic paper. The figures thus are equivalent to negatives rather than positives.

The methodology and preparation of most of the figures has been by two students, Miss Marilyn Miller and Mr. William Cutler, both of the University of Kansas, to whom I am most grateful. A few of the figures have been used in other of my publications. I also present a few phase contrast photographs prepared for me by Dr. Paul R. Burton, Department of Physiology and Cell Biology, Kansas University.

Museum Abbreviations

AMNH	American Museum of Natural History, New York, New York.
ANSP	Academy of Natural Sciences, Philadelphia, Pennsylvania.
BMNH	British Museum (Natural History), London, England.
CAS	California Academy of Sciences, San Francisco, California.
CMNH	Field Museum of Natural History (formerly, Chicago Museum of Natural History).
DSBM	Division of Systematic Biology, Museum, Stanford, California.
EHT-HMS	Edward H. Taylor-Hobart M. Smith, Herpetological Collection, Lawrence, Kansas.
JAP	James A. Peters, Private Collection.
KUMNH	Kansas University Museum of Natural History, Lawrence, Kansas.
MCZ	Museum of Comparative Zoology, Harvard College, Cambridge, Massachusetts.
MHNB	Musée d'Histoire Naturelle, Bâle, Suisse.
MNHN	Musée National d'Histoire Naturelle, Paris, France.
MRAC	Musée Royal de l'Afrique Centrale, Belgium.
NMW	Naturhistorisches Museum, Wien, Austria.
RNHL	Rijksmuseum van Natuurlijke Historie, Leiden, Netherlands.
UCVMB	Universidad Central de Venezuela, Museo de Biología, Caracas, Venezuela.
UMMZ	University of Michigan Museum of Zoology, Ann Arbor, Michigan.
USNM	United States National Museum, Washington, D.C.
ZMA	Zoölogisch Museum, Amsterdam, Netherlands.
ZMB	Zoologisches Museum, Berlin, Germany.
ZSIC	Zoological Survey of India, Indian Museum, Calcutta, India.
ZIASL	Zoological Institute of the Academy of Sciences, Leningrad.

GENERAL OBSERVATIONS

The typical scales of the folds (as opposed to the subdermal scales) are to be found in the spaces below the folds, most often in small individual pockets of thin transparent tissue. The folds may pass completely around

the body, or they may be in two parts broken dorsally, or ventrally, or often both dorsally and ventrally. Thus the scales are restricted by the character of the folds. Not all species develop secondary folds on the primaries, but when they are developed they will tend to have the same kind and number of scale rows that the primary folds have.

The distribution of scales on the body varies in different species. In some the scales may be present in the collars, or on the neck following the collars. In many species they begin to appear at about the 25th fold. In others they may not begin until a few folds preceding the vent.

The scales when they first appear anteriorly are small with their greatest dimension transverse. Farther back the scales will become larger and they may tend to elongate more and become somewhat quadrangular or circular, or they may be longer than wide. The number of scales in a row and the number of scale rows in a fold also varies. In some species there may be only a single scale row, while in others the number may be as many as ten rows. The same will be true of the secondary folds when they have the same development as the primaries. In the family Ichthyophiidae where the secondaries folds are indistinguishable from the primaries, the secondaries will have the same quota of scales throughout the body as do the primaries.

The actual size of the scales vary. They may measure less than 0.5 mm in their greatest dimension while in certain other species the individual scales may reach 4.5 mm in their greatest dimension.

The details of the formation of the individual scales are not too well known. The general make-up of a scale is of a flat basal portion bearing on its surface usually hundreds or perhaps more than a thousand small individual scales or squamulae. These general facts were observed and reported by the Sarasins in their magnificent monograph on *Ichthyophis glutinosus* (1887). Just how the basal part is formed is uncertain, but many scales can be teased with a needle and threadlike fibrous strands drawn out at the periphery with the individual squamulae still attached to them.

The large scales will be found attached at their anterior borders. In certain specimens that have been somewhat desiccated it may be possible to discern the scales through the skin and in at least one species the scales appear to be normally exposed behind the edges of the fold.

The Figures 2 to 8 show enlargements of an area of scales, from several species, at a magnification of about 950×. Often somewhere near the center of the scale there may be observed a group of irregular squamulae more or less concentrically arranged, an area which is here designated the *initium*, presumably the first part of the scale laid down. The other squamulae are added about the periphery, the largest ones usually posterior to the initium, the smaller ones more laterally and anteriorly.

In many of the figures of whole scales at less magnification, the individual squamulae are difficult to discern. In many instances, in fact, the scales are so small that the individual squamulae are difficult to resolve even with optical magnification. Yet they are present on all scales.

The squamulae are thicker than the areas of the scale between them; in the figures they appear dark. When photographed the squamulae appear light and are separated by darker borders. Figure 1 shows the two conditions contrasted.

In many cases one is able to observe in the figures differences in the scales of different genera, and perhaps to a lesser extent in the scales of different species. In certain of the genera, it is not always possible to discern differences in the specific characters. However, if one utilizes together with the individual scale characters, their size, numbers and distribution on the body, they are unquestionably of value in distinguishing species.

Many species have scales which show what are regarded as lines of growth. These in the scale would be added to the periphery and not equally at all points.

Robert C. Feuer (1962) examined scales from one or more caecilians identified at the University of Michigan as *Gymnophis m. mexicanus* from Volcán Zunil (Finca El Ciprés), Suchitepequez, Guatemala. The scales were taken from the dorsal surface at a point 20-30 mm from the terminus of the body of specimens varying in length from 172 to 555 mm. He states: "Inasmuch as the number of these growth checks in each individual seemed to be correlated with the length of that individual, I asked that impressions of the scales be studied by the Division of Fisheries, School of Natural Resources, The University of Michigan. The scales were tentatively aged by William Wellers and Karl F. Lagler as follows (total length and age): 172 mm—2 spec. one and two years respectively; 217 mm—two years; 292 mm—three years; 555 mm—three years. The calculated ages if correct indicate a substantial variation in the rate of growth. ". . . All scales from the same individual (3) gave the same reading. Despite the small size of the sample, the close correlation between number of growth checks and size of the individual suggests that the checks are formed annually and that their number is not due to individual variation."

One may find much to question in these particular results since there is a considerable variation in the size and character of the scales in any particular groove. A few species show what these workers would call "annual lines of growth," while many species would seem to show no obvious trace of annular growth. If such lines are discernible one might expect them to be most in evidence in forms existing in areas where there was considerable change in annual temperature, or where a dry and a rainy season alternated.

There are likewise differences in various species, within a given locality. Some may show the presumed lines of growth, others do not.

The extent to which the scales themselves might be used in the recognition of higher categories of caecilians is, I believe, small. Peters (1879), in his classification of what he regarded as a single family of the Gymnophiona, utilized two names to divide the Caeciliidae—Lepidocaeciliae and Gymnocaecilae. He did not designate the rank of these names, which have to do with the presence or absence of scales. The names were apparently not used again by Peters. Marie Phisalix (1910), in referring to the terms, calls them suborders. In the literature, I have seen only one other mention made of these names.

Taylor (1968) proposed two new families, Ichthyophiidae and Typhlonectidae, the former with scales, the latter lacking them. A year later (1969b) a third family was proposed—the Scolecomorphidae. This too lacks scales. At the same time he separated the other previously known family Caeciliidae into two subfamilies. The presence or absence of scales was noted but was of little weight in the separation of the groups. I do not

TABLE 1. The caecilian genera and species having scales.*

	Family Ichthyophiidae	
Genus	*Ichthyophis*	28 species
Genus	*Rhinatrema*	1 species
Genus	*Caudacaecilia*	5 species
Genus	*Epicrionops*	10 species and subspecies
	Family Caeciliidae	
Subfamily Dermophiinae		
Genus	*Cryptosophis*	1 species
Genus	*Brasilotyphlus*	1 species
Genus	*Dermophis*	12 species and subspecies
Genus	*Gymnopis*	3 species
Genus	*Microcaecilia*	3 species
Genus	*Parvicaecilia*	2 species
Genus	*Idiocranium*	1 species
Genus	*Schistometopum*	4 species
Genus	*Herpele*	2 species
Genus	*Uraeotyphlus*	4 species
Genus	*Geotrypetes*	7 species and subspecies
Genus	*Gegeneophis*	3 species
Genus	*Indotyphlus*	1 species
Genus	*Grandisonia*	5 species
Genus	*Praslinia*	1 species
Genus	*Hypogeophis*	4 species and subspecies
Subfamily Caeciliinae		
Genus	*Oscaecilia*	6 species
Genus	*Caecilia*	21 species (part)

* The number of species indicated includes all the genus unless noted.

TABLE 2. The caecilian genera and species seemingly lacking scales throughout life.*

		Family Typhlonectidae	
Genus		*Typhlonectes*	6 species
Genus		*Nectocaecilia*	4 species
Genus		*Potamotyphlus*	2 species
Genus		*Chthonerpeton*	6 species
		Family Scolecomorphidae	
Genus		*Scolecomorphus*	6 species
		Family Caeciliidae	
Subfamily Dermophiinae			
Genus		*Siphonops*	6 species
Genus		*Pseudosiphonops*	1 species
Genus		*Luetkenotyphlus*	1 species
Genus		*Mimosiphonops*	1 species
Genus		*Boulengerula*	1 species
Genus		*Afrocaecilia*	3 species
Subfamily Caeciliinae			
Genus		*Caecilia* (part)	
	Species	" *attenuata* (part)	
	Species	" *caribea* (all)	
	Species	" *corpulenta* (all)	
	Species	" *orientalis* (part)	
	Species	" *degenerata* (part)	

* The number of species indicated includes all the genus unless otherwise noted.

consider it feasible to regard Peters' names as of subordinal value, since one of the families, Caeciliidae, *sensu strictu*, with two subfamilies, would have to have both subfamilies divided and placed in two different suborders. Their actual relationships do not warrant such an association.

While the Typhlonectidae and Scolecomorphidae lack scales, it was on the basis of numerous other characters that their separation from the Caeciliidae was warranted. However, it seems certain that scales are of significant importance in separating species and subspecies, and perhaps to a lesser extent genera.

Of the four families of caecilians the Typhlonectidae and the Scolecomorphidae completely lack scales. In the Ichthyophiidae scales are invariably present. Both subfamilies of the Caeciliidae have certain scaled genera, and others lacking scales. In two or three cases the species may vary in this respect and in individuals of a single species population one may find scales present or absent. Tables 1 and 2 summarize the distribution.

We have suggested that the scales may serve in the control of water acquisition or loss through the surface. When scales are lost partly or entirely, it would appear that some other mechanism would take over. In

the caecilians the skin is extremely well supplied with small glandules that provide mucous secretions which themselves may likewise subserve the same function as the scales. In some terrestrial species the skin may be otherwise modified to prevent surface loss of moisture.

A word of explanation is due concerning the method of presenting the following data. The species are arranged by family and genus. Except where otherwise specified, descriptions of the species discussed may be found in Taylor (1968). Here usually a few pertinent characteristics are given such as size, number of annuli, and sometimes color and dentition. In some cases additional distinguishing characters are indicated where the scales fail to present fairly well-defined distinguishing characteristics of the species.

In each figure all scales are enlarged to the same magnification unless noted to the contrary. Also, unless otherwise stated, all illustrated scales are from the dorsal area of the last cm preceding the vent.

SPECIES ACCOUNTS

Family **Ichthyophiidae** Taylor

Genus **Ichthyophis** Fitzinger

Ichthyophis acuminatus Taylor

Fig. 10

This species is known to reach a length of 295 mm, with a body width of about 14.6 mm. The vertebrae in the four known specimens are 109 or 110. The primaries and secondaries total 319-332 (dorsal count), 297-322 (ventral count). The splenial dental series are 22-22.

Scales are present in the posterior two thirds of the body. At first the rows are incomplete but there are 2 rows in the folds of the greater part of the body. Sometimes the scales are not contiguous in the rows. The largest scales are those figured.

Ichthyophis atricollaris Taylor

Figs. 2, 11

This form reaches a length of 285 mm (type) with a body width of about 11 mm. The total folds of the three known specimens are 263-275, 300-310, and 293-303 (ventral and dorsal counts).

Scales begin at about the 25th fold with a few scattered dorsal scales. At the middle of the body there are 3 or 4 rows, and 7 or 8 rows in the posterior part of the body in each fold.

The largest scale from the last fold of the type preceding the vent measures 0.9 × 1.7 mm.

Ichthyophis beddomei Peters

Fig. 12

This striped Indian species reaches a known length of 270 mm. The body width of the same specimen is 15 mm. Variation in the counts of the transverse folds is between 256 and 285, there being but little difference in the dorsal and ventral counts. The vertebrae of 4 specimens vary, 102-105.

Scales begin on the folds on the second collar. They increase in number of rows posteriorly so that in much of the body there are 6-8 rows in each fold. The largest scales measured are 1.0 × 1.3, 1.2 × 1.2, 1.4 × 1.4 mm.

The individual scales show good definition of the squamulae and the initium is frequently near the center of the scale.

Ichthyophis biangularis Taylor

Fig. 13

This mountain form reaches a known length of 258 mm and a body width of 9.8 mm. There are 333 (dorsal count) and 330 (ventral count) transverse folds. Unlike most species of caecilians the transverse folds form a dorsal angle as they cross the back. In the genus *Ichthyophis* almost all of the species have the fold angulate, the angle pointing backwards on much of the ventral part of the body. A few species may have a very few folds more or less angular on the neck that point forward as in *biangularis* (Cf. *I. pseudoangularis*). This species has a yellow lateral stripe beginning on the back of the second collar.

The scales are present in the first folds. Anteriorly there are 2 rows in each that increase to 4 well-developed rows posteriorly in each fold. Practically all scales are transversely widened; however, those forward are proportionally wider than those in posterior areas.

Ichthyophis billitonensis Taylor

Fig. 14

This species is probably a diminutive one as the type measures only 135 mm. It is seemingly adult with the transverse folds 251-254. There is no stripe and the splenial teeth are reduced to 1-1.

Scales are present close to the collars. At the middle of the body there are 2 rows in a fold and posteriorly there are 3 rows with some scattered scales.

Ichthyophis bombayensis Taylor

This unstriped species measures 390 mm in length, the body width 15 mm. There are 386 transverse folds on the body and tail, 14 of which are confined to the tail.

Scales begin on the neck with a single row of scales in each fold. Posteriorly the rows increase to 3, the median series largest.

This form is known from only the single type. Larger series may show a closer relationship with the light-bellied forms, *peninsularis* and *malabarensis*, that are known in Southern India. These too are large forms, with relatively long tails and lacking the lateral stripe. However, *malabarensis* has nearly double the number of scales and the tail is not sharply acuminate as in *bombayensis*.

Ichthyophis dulitensis Taylor

Fig. 15

This specimen was first referred to *Ichthyophis monochrous* of Bleeker by Boulenger without comment. It differs from that species, however. It has considerably more transverse folds—313 as compared with 247, and a known difference in vertebrae, 114 as compared with 103 in *monochrous* (type). The species is known to reach a length of 232 mm. The number of splenial teeth is the same in the two forms. *I. dulitensis* has a whitish spot on the throat.

The scales begin in the first quarter of the body where they are small and somewhat scattered. In the posterior parts there are 4-5 rows in each fold.

More specimens from this region will help in determining the relationship of these two forms. The datum on actual elevation of *dulitensis* is "somewhere between 2000 and 5000 ft." No paratypes are known.

Ichthyophis elongatus Taylor

Fig. 16

This is a slender striped form know from two Sumatran specimens. It reaches a length of 300 mm with a body width of 7.6 mm. There is but little difference between the dorsal and ventral counts of the transverse folds, the known range in the species being 274-287 dorsal count. The splenial tooth series is 14-14 or 16-16.

Scales are present on the second collar. From here they increase in numbers so that at the middle of the body there are 7 rows in each fold. This number continues to the end of the body, the individual scales increasing in size.

Ichthyophis forcarti Taylor

Fig. 17

This species bears a considerable similarity to *Ichthyophis glutinosus*. The differences are at first not obvious. It has a smaller number of transverse folds, less than half the number of splenial teeth, wider collars, a more

acuminate tail, and a marked difference in the characters of the palatal region. Presumably it is a smaller species, the type being 236 mm in length, the body width 8.6 mm.

Scales are present on the second collar. At the middle of the body there are 5 scale rows in a fold, which number continues to the end of the body. (In *I. glutinosus* there are usually 8 scale rows in the latter part of the body.)

Ichthyophis glandulosus Taylor

This species reaches a known length of 250 mm, with a body width of about 11 mm. The combined primaries and secondaries are from about 273 to about 302. In a single specimen there may be a difference of 6-8 in dorsal and ventral counts.

Scales are presumably absent anterior to the 60th fold. At the 88th fold 3-4 scales are present on each side in a single row. These are very small (0.25 to 0.5 mm in their greatest dimension). Posteriorly there are 3 and 4 rows in the primary and secondary folds, the scales usually less than 1 mm in greatest dimension.

Ichthyophis glutinosus (Linnaeus)

Fig. 18

This species reaches a length of about 400 mm with combined primary and secondary folds about 342 to 392. There is of course variation in the count of each specimen depending on what point on the circumference the count is made. I have considered Ceylon as the most probable type-locality, and presume that it is largely if not entirely confined to that island, notwithstanding literature references to the contrary.

Scales are present on the collars, and 2 rows in each fold by the 25th fold. There are 5 rows in each fold before the middle is reached, and 7 or 8 rows throughout most of the latter half of the body. Thus one may estimate that there are more than 2000 scale rows altogether.

Ichthyophis hypocyaneus (Van Hasselt *in* H. Boie *in* F. Boie)

Figs. 19-20

This Javanese species is known to reach a length of 260 mm. The body folds number 314-320, with 7 folds confined to the tail. There is a narrow cream or yellow lateral stripe, sometimes broken.

Scales are present on the collars and continue through to the end of tail. On the anterior parts there are 2 or 3 scale rows in each fold. Posteriorly the number increases to 5 rows in each fold, the rows often not complete on the venter.

Ichthyophis javanicus Taylor

Fig. 21

This form occurs in the same territory with *I. hypocyaneus*. It differs in having a larger number of transverse folds, and a slenderer body. The scale characters and scale distribution are quite different.

The species is known to reach a length of 210 mm and a body width of 6 mm. The transverse folds range from 348 to 351 in dorsal and ventral counts in the type. The stripe is lacking. There are 10 folds on the tail, about 6 complete behind the vent.

Scales are absent in the anterior part of the body. In the posterior part of the body there are 1 or 2 rows in a fold.

Ichthyophis kohtaoensis Taylor

Fig. 22

This species, known to occur in the Malay Peninsula, Thailand, Cambodia, Viet Nam, Laos and Burma, is a rather large species reaching a known length of about 350 mm. There is considerable variation in the number of transverse folds on the body and some populations may be worthy of subspecific designation. The types are from the Island of Koh Tao lying about 70 km off the east shore of Thailand, in the Gulf of Siam.

The scales of this species begin at the collars where the rows in the folds are incomplete. Somewhat more posteriorly they become complete. Near the middle of the body there are 4 rows in each fold and this number continues in the posterior half of the body. The largest scales measure 2.1 × 2.7, 1.9 × 2.0 and 2.0 × 2.2 mm.

Squamulae of the lower scale figured are seemingly slightly better defined and are vaguely larger. The initium is nearer the upper border of the scale.

Ichthyophis laosensis Taylor

Figs. 3, 23-24

Ichthyophis laosensis Taylor, Univ. Kansas Sci. Bull., vol. 48, no. 9, May 16, 1969, pp. 292-296, figs. 7-9 (type-locality, "haut Laos").

This species is based only on the type. The specimen is uniformly fawn color with little difference in the dorsal and ventral scale counts. The total transverse folds on the body are 345 (ventral count) and 346 (dorsal count). The tail is extremely short with 5 folds, 2 interrupted by the vent. The length is 318 mm, the width in length about 24.5 times. The splenial dental series is 16-16.

The scales first appear at the collars, the rows incomplete. At the middle of the body there are at least 2 rows, increasing to 3 rows in the folds of the posterior parts of the body. The largest scale measured is 1.5 × 2.0 mm. It appears in Figure 23.

Ichthyophis malabarensis Taylor

Fig. 25

This species is known to reach a length of 500 mm, with a body width of about 21 mm. In the type there are 111 vertebrae and a total of 354-360 transverse folds of which about 17 are confined to the tail (anterior part of vent to tip).

Scales are present in the first anterior fold. At the 25th fold there are 4 rows and these increase gradually to 10 rows more posteriorly. Thus one may conservatively estimate a total of near 2500 scale rows.

Ichthyophis mindanaoensis Taylor

Fig. 26

This species reaches a length of 327 mm with a body width of 12 mm. The combined transverse folds, primary and secondary, range from 294 to 326 (dorsal count). The ventral count is usually 4 or 5 less. One specimen has 111 vertebrae.

The scales begin on the second third of the body as a partial scale row in a fold. Farther back they increase so that 4 rows are present in the folds of the posterior part of the body. The scales are smaller anteriorly, but transversely widened throughout the body.

Ichthyophis monochrous (Bleeker)

This is a small unicolored species, the largest size known being 232 mm. The primary and secondary annular folds are 247 (somewhat variable at different points on the circumference). The length in width is about 23 times. Splenial teeth are 4-4.

The scales begin near the collars, each fold with 1 or 2 rows. This number of rows increases posteriorly to 5 or 6 in each primary and secondary fold.

A specimen from Sarawak (Taylor, 1968, p. 115), which differed considerably from the type of *monochrous*, was left unassigned. It differed in having a length of 209 mm. The annular folds, 292-295, were more numerous. The vertebrae number was only 103. There are 3 scale rows on the neck folds, increasing to 8 rows posteriorly. More materials are necessary before this form can be placed correctly.

Ichthyophis orthoplicatus Taylor

This is a species lacking a lateral stripe and seemingly differing from other species of *Ichthyophis* in having the folds cross the venter without forming an angle. The number of transverse folds is 291-305,* about 6 con-

* Incorrectly stated 205 in Taylor (1968, p. 115).

fined to the tail. The length of the type specimen is estimated to have been about 235 mm. The splenial teeth are 9-9.

Scales begin near the collars. At first 1 or 2 rows of scales are present. Farther back the number gradually increases so that there are at least 6 rows present in the terminal body folds.

Ichthyophis paucisulcus Taylor

Fig. 27

This is a short, relatively thick-bodied species reaching a known length of 263 mm, with a body width of 12.3 mm. The type is even wider although the length is 256, the width in length about 17 times. The transverse folds vary from 259 to 286 (dorsal count), the ventral count 4 or 5 less in each case. The tail is usually less than 4 mm long. The lateral stripe begins at the eye and runs back to vent level. It does not send a branch to the lower jaw at the mouth angle. There is a slight break on the second collar in some specimens. There is a large series of splenial teeth (14-14).

Scales are present in most of the anterior half of the body. Towards the posterior part of the body there are usually 4 or 5 scale rows in each fold. The scales are relatively large.

I have tentatively referred specimens from Pagi and the Nias Islands to this form despite certain presumed differences. It has been taken in a number of localities in Sumatra.

Ichthyophis peninsularis Taylor

Fig. 28

This is an unstriped, thick-bodied species reaching a total length of 450 mm, the tail 15.2 mm. The body width is about 14.8 mm. There are 117 vertebrae in the type. Three specimens show a variation in count of folds of 359-374 (dorsal count), 355-373 (ventral count). About 17 folds are confined to the tail. The ventral coloration is whitish (cream) or yellow in life. The splenial teeth are reduced (4-4 to 6-7).

Scales begin to appear just back of the neck. The number of rows in a fold varies from 1 (anteriorly) to a maximum of about 5 posteriorly.

Ichthyophis pseudangularis Taylor

Fig. 29

This medium sized species has a known length of 225 mm and a body width of about 8.6 mm. The total number of folds is 269 (ventral count), 272 (dorsal count). Superficially it resembles *Ichthyophis biangularis* and the anteriormost folds (and grooves) tend to form a forward projecting angle on the anterior dorsal part of the body. There is a stripe from the second collar to the tail and a white spot at the mouth angle dividing and partly passing to the lower jaw. There are about 10-10 splenial teeth.

Despite the superficial resemblance, *biangularis* has 330-333 body folds, 10 confined to the tail (only 5 in *I. pseudangularis*). The splenial teeth are 2-2.

In *pseudangularis* the scales appear on the second collar. Passing back there are at least 2 rows of scales in the 10th fold, and in the latter half of the body there are 6-8 rows in each fold. (In *biangularis* there are but 4 rows in the posterior folds.) The scales are small, the largest measuring 1.0 × 1.2 and 0.8 × 1.1 mm.

Ichthyophis sikkimensis Taylor

Fig. 30

Of the 4 specimens I have seen of this species the largest has a length of 276 mm and a body width of about 12 mm. The total folds are 276-292. The vertebrae of three are 106, 107, 108.

Scales are absent in most of the anterior part of the body. Two to 4 rows are present in the latter half.

Ichthyophis singaporensis Taylor

The type-specimen measured (or was estimated) 243 mm, the body width about 12 mm; the primary and secondary annular folds are 267, of which 7 are confined to the tail. The known variation of folds is from 260 to 273 (four specimens). There are 111 vertebrae in one.

Scales appear on the second collar where 2 scale rows are present in each fold dorsally; from here the rows increase in number so that there are 7 or 8 rows in each fold throughout much of the body.

Ichthyophis subterrestris Taylor

Fig. 31

The species reaches a length of 295 mm with a body width of 13 mm. The total number of annuli range from 364 to 383 and the number of caudal folds ranges from 10 to 18.

The anterior annuli, beginning somewhat back from the collars, have 1 or 2 scale rows, their number increasing to 4 or 5 in the posterior part of the body.

An x-ray of the type showed no trace of a bony skeleton (presumably an all-cartilage skeleton), presumably an abnormal condition. Other specimens have a bony skeleton. I have no reason to suspect that the calcium had been removed by the preservative.

Ichthyophis sumatranus Taylor

Fig. 32

The species is known to reach a length of 285 mm and a body width of

about 9 to 10 mm. The total folds range from 295 to 329. The vertebrae in the type are 112.

Scales begin somewhat back from the collars and are confined to the sides of the folds at first. Farther back they increase in number of rows to 3, and in the posterior part of the body there are 5 rows in each fold. The largest scales measure 1.0 × 1.4 and 0.9 × 1.1 mm.

Ichthyophis supachaii Taylor

Figs. 1, 33

This form reaches a length of 306 mm with the body width approximately 10 mm. The total folds on the body have a known range from about 313 to 322. In Figure 61, Taylor, 1968, the dentary teeth are incorrectly depicted. It seems most probable that the reduced dentition is not due to group loss of alternate teeth, which were supplied by the artist (but which has been done correctly in species of *Caecilia* where there is group loss).

Scales are absent in the folds immediately following the collars. At first, about the 15th fold, there may be an incomplete single row but throughout most of the body increasing posteriorly there are 3-5 scale rows.

Ichthyophis tricolor Annandale

Figs. 4, 34

This striped form is known to reach a length of 296 mm. It has 104-110 vertebrae with a total of 245-279 primary and secondary folds, 5 of which are confined to the tail.

Scales begin at the collars, the anterior folds having 3 scale rows, increasing posteriorly to 7 or 8 rows. This number is continued to the termination of the body. The total number of scale rows may be conservatively estimated at well above a thousand.

Ichthyophis taprobanicensis Taylor

Fig. 35

Ichthyophis taprobanicensis Taylor, Univ. Kansas Sci. Bull., vol. 48, no. 9, May 16, 1969, pp. 291-292, figs. 5-6 (type-locality, "Ohiya Area Ceylon," 5500 ft. elev.).

This is an unstriped species. The type (AMNH 64515) is 260 mm in length, the body width about 11 mm. There are 291-293 primary and secondary folds together, 9 of which are confined to the tail.

Scales begin on the second collar and there are 2 or 3 rows in the anterior folds. The rows increase to 5 near the middle of the body and in much of the latter half of the body there are 7 or 8 rows in each primary and secondary fold.

The character of the scales in the posterior part is different from the forward scales. Instead of being transversely widened they are largely

subcircular. The initium of the scale is somewhat anterior to the center, the squamulae arranged in curved parallel rows on the sides of the scales. The squamulae are relatively large, distinct, and more nearly retain their same size throughout the surface.

Ichthyophis youngorum Taylor

Fig. 36

This species reaches adult size as a larva. The greatest known length of an adult (2 specimens) is 220 mm, while the largest larva measured is 240 mm! The primary and secondary folds together are 310-326 (dorsal count) and 276-304 (ventral count).

Scales appear to be wanting in the anterior third of the body. In the posterior two thirds there is usually one overlapping row in each fold.

Genus **Rhinatrema** Duméril and Bibron

Only a single species is known.

Rhinatrema bivittatum (Cuvier *in* Guérin-Méneville)

Figs. 5, 37

This distinctive genus, described 130 years ago, is still known only from the two type specimens in the Paris Museum. It reaches a known length of 207 mm with about 84 to 90 vertebrae. The vent is transverse. There are in the type about 364 to 368 body folds, primary and secondary (count varies, taken at various points on body circumference). The tail is extremely short (1.95-2.8 mm). A frontal white or cream spot is present.

Scales begin on the second collar. They at first are in a single incomplete row, transversely widened. The number of rows in a fold does not increase posteriorly, but the rows become complete and surround the body. Occasionally there may be one or more extra scales, usually small and beneath the main row. Usually there is also a median single scale dorsally that is overlapped both left and right; occasionally there are two. The scales are relatively large. Several were measured, the largest being 2.0 to 2.4 mm in greatest dimension. Their most characteristic feature is that the initium is far forward on the scale. In Figure 37 the individual squamulae are shown to be somewhat square and to maintain this same general shape over much of the scale. This arrangement is indeed one of the most individual types in the order.

Genus **Caudacaecilia** Taylor

Taylor (1968) recognized five species in this genus, *C. asplenia, nigroflava, pancidentula, weberi,* and *larutensis.* The genus is distributed from Palawan Island to Borneo, Sumatra, Malaya, and Thailand.

The chief difference between the genera *Caudacaecilia* and *Ichthyophis* is the loss of the splenial teeth in the former. In larval forms the splenials may be present but as in certain genera of salamanders these are lost entirely at the larval transformation to the adult, and the jaw itself seems to lose a bony portion that supported the splenials.

Caudacaecilia larutensis (Taylor)

Fig. 38

This form is as yet known only from the Larut Hills in Malaya; it reaches a known length of 252 mm with the folds ranging from 298 to 310. The folds are incomplete dorsally on much of the anterior part of the body. There are 107 vertebrae in the type.

Scales appear in the second quarter of the body with at least one row complete at the middle. Farther back and continuing so to the vent there are 2 or 3 rows. Measurements of four largest scales found were 0.8 × 1.2, 0.7 × 1.1, 0.9 × 1.2, 0.8 × 1.0 mm.

Caudacaecilia asplenia (Taylor)

Fig. 39

This small striped species has the folds incomplete across the back on much of the anterior part of the body. The total number of folds, primary and secondary, is known to vary between 247 and 270. There is also a differential count on the same individual made at different points on the circumference. The species reaches a known length of 236 mm. It is known to occur in Borneo, Malaya, and Thailand. Two doubtful specimens purport to be from Ceylon.

A few small scales are present in the 30th fold. These increase in size and number of rows in each fold posteriorly but the scale rows are incomplete until the fold itself becomes complete. There are 3 rows near the middle of the body, increasing to 5 posteriorly.

Caudacaecilia nigroflava (Taylor)

Fig. 40

This striped species, known from Borneo, Malaysia, and Sumatra reaches a known length of 425 mm and is the largest known in the genus. The length divided by width ranges between 26 and 32. The primary and secondary folds have a tendency to redivide in an irregular fashion. A count on the dorsal part of the body varies from 389 to 433 folds; on the ventral or ventrolateral region the count varies from 376 to 433 (usually fewer than dorsally). The counts would still vary if they were made at other points on the circumference. The number of vertebrae in the type is 123. Thus it is obvious that each primary has 3 or 4 secondaries.

Scales begin shortly posterior to the collars and increase in numbers and number of rows in a fold posteriorly. At the middle of the body 4 is the usual number of rows per fold, while in the posterior part preceding the vent there are 6.

Caudacaecilia paucidentula (Taylor)

Fig. 41

This species, known from Sumatra and Java, has a barely distinguishable lateral yellowish stripe which is broken irregularly at points on the sides. It reaches a known length of 295 mm. The total number of primary and secondary folds on the body is 384-390, the counts varying in the same individual depending on the point on circumference of the body at which the count is made. There are 122 vertebrae. The tail is relatively long with 7 folds present. The body width in length is about 34 times.

A few tiny transversely widened scales are present just following the collars, while near the middle of the body there are 2 nearly complete scale rows in the folds. Posteriorly there are 2 complete and a 3rd partial row.

Caudacaecilia weberi (Taylor)

Fig. 42

This small species, presumably restricted to the island of Palawan in the Philippines, is known to reach a length of 258 mm (11 specimens); the width in length varies from 21 to 25 times. There is considerable variation in the counts of folds on a single specimen depending on the point on the circumference where the count is made since the folds tend to split or coalesce in a hit or miss fashion. The counts in the series of specimens varied from 301 to 340 which seems a large range but is equivalent to a difference of 15 primaries, a range to be expected in most species.

Scales begin in folds close to the collars and increase in numbers posteriorly. At the middle there are usually 2 or 3 rows, but soon increasing to 4 more or less complete rows in each fold. The scales are smallest anteriorly where they may measure only 0.1-0.5 mm in greatest (transverse) dimension. They are considerably larger posteriorly but the greatest dimension is transverse.

Genus **Epicrionops** Boulenger

The genus is confined so far as known to the western and northern parts of South America. The species of this genus have been associated with *Rhinatrema,* another South American genus of the family Ichthyophiidae, having a transverse vent. In *Epicrionops* the vent is longitudinal. The two genera differ in numerous other characters. Taylor (1968) recognized ten forms under eight species in the present genus. Some of the species are

more or less unicolor, some have a lateral yellow or cream stripe much as occurs in some species of *Ichthyophis* and *Caudacaecilia* in the Old World.

Like the Asiatic forms the primary folds usually bear 3 or more secondary folds. Occasionally one or more folds following the collars may lack secondaries, as is true also in some Asiatic forms of this family. Scales in folds are present in all known species, but the subdermal scales common to many South American caecilians are absent.

Epicrionops bicolor bicolor Boulenger

Fig. 43

This striped subspecies, reaching a known length of 230 mm with 240-244 primary and secondary folds (14 confined to the tail), is known from a single specimen. It is presumably in the Pacific drainage area.

Scales begin on the collars. At the middle of the body there are 2 scale rows in each fold, and 3 in the posterior body folds where the scales are largest.

Epicrionops bicolor subcaudalis Taylor

Fig. 44

This subspecies, known from a number of specimens, would appear to be confined to the eastern face of the Peruvian Andes. It shows a wide range in the number of folds (252-312). The vertebrae number 75-78. The greatest known length is 270 mm. The first collar is partly divided by a transverse dorsal groove, the second by 4 grooves.

Scales appear on the collars. They are present on all succeeding folds, usually 2 scale rows in each fold, the scales relatively large.

Epicrionops columbianus (Rendahl and Vestergren)

This species, lacking a lateral stripe, is known only from the type. It measures 161 mm, the greatest width in length about 20 times. There are together 227 primary and secondary folds (11 from anterior level of vent to tip of tail).

I have not examined the type specimen. In Rendahl and Vestergren, 1938, figure 2, A, B, C, and figure 3 illustrate the scales. The scales designated A, B, and C are from the anterior, the middle and posterior parts of the body. Figure 3 depicts one from the tail region. The magnification is the same in all, the middle scale largest, the posterior body scale smallest! This hardly agrees with my findings in most scaled caecilians or with a series of measurements given elsewhere in their paper. These are: anterior part of body, maximum size, 0.58 × 0.96, 0.61 × 0.90 mm; for the middle of body, 0.92 × 0.79, 0.71 × 1.17 mm; posterior part, 0.96 × 1.54, 1.23 × 1.38 mm; caudal region, 0.83 × 0.92, 0.75 × 0.81 mm.

Epicrionops lativittatus Taylor

Fig. 45

This species, known only from the type, is characterized by a lateral cream stripe 5.5-7.0 mm wide. The body length is 218 mm, and the body width in the length is approximately 15.5 times. There are 78 vertebrae. The total of primary and secondary folds is 268 of which 22 are on the tail (front of vent to tail tip). There is a single transverse groove on the first collar. The second collar has 5 transverse grooves which tend to divide it into 6 folds dorsally.

Scales begin on the collars, where they are small and transversely widened in 1 or 2 partial rows. They increase in size and number of rows posteriorly, so that near the middle there are 3 rows in each fold while near the terminus of the body the number is 4 with frequently a few extra scales. The largest scales in the folds in the centimeter preceding the vent measure 1.3 × 2.2, 1.65 × 1.8, and 1.2 × 1.0 mm. Anteriorly they are usually less than 1.0 mm in their greatest dimension.

It may be noted in Figure 45 that the initium is very close to the anterior edge and the squamulae are proportionally large and fairly uniform over much of the scale.

Epicrionops marmoratus Taylor

Fig. 46

This form lacks a distinctive white lateral stripe but the sides of the venter are lighter than the rest of the body and the dorsum is marbled. It is known to reach a length of 299 mm, while the width in length is approximately 21 times. There are some 5 or 6 dorsal folds on the second collar. The primary and secondary folds of the type together are 327 (dorsal) and 320 (ventrolateral count), 25 of which are confined to the tail (anterior level of vent to tail end).

Scales begin on the collars and are small. They increase in size posteriorly but there is only a single overlapping scale row with occasionally extra scales throughout the body.

Epicrionops niger (Dunn)

Fig. 47

This poorly described species is dependent on a neotype chosen by Taylor (1968) from a locality perhaps not more than 100 miles from the presumed type-locality of the original type. The neotype has a length of 272 mm, and the body width in length is about 19.5 times. The tentacular opening is placed slightly above and very close to the eye. The splenial teeth (15-15) are more numerous than the dentary teeth (11-11). Of the two collars the first has 3 short transverse folds, the second 6 short transverse

folds (not counted with the body folds). The total folds following the collars are 367-372 (variable at different points on body circumference).

Scales first are to be found on the collars, and continue posteriorly to the end of the tail. There is never more than one complete row of scales in a fold, but often there are a few scattered extra scales (see Taylor's, 1968, discussion of the data on the original type).

Epicrionops peruvianus (Boulenger)

Fig. 48

This uniformly colored species is known only from the type. It is 286 mm in length, and 12 mm in width. There are 362-367 body folds. The 6 transverse folds on the second collar are not counted with the body folds.

A few scales are present at the 20th fold and, in most of the body following this, there is but a single row of scales in each fold, with occasional extra scattered scales intercalated. The scales of this species attain a somewhat larger average size than in some of the other species of the genus. From one fold in the segment preceding the vent, scales of the following dimensions were taken: 1.2 × 1.8, 0.7 × 0.9, 1.2 × 2.2, 1.5 × 2.35, 1.6 × 2.9 mm.

Epicrionops parkeri (Dunn)

Fig. 49

The only certain representative known of this striped species, the type, measures 208 mm in length, the body width in length approximately 25.5 times. The number of folds following the collars is 410 of which 22 are confined to the tail. There are 84 vertebrae present.

The scales begin on the collars with an incomplete row in the first fold following the collars. Only a single overlapping scale row occurs throughout the body folds. Dunn (1942) reports 210 primaries but, since there are but 84 vertebrae, this number is certainly an error.

Epicrionops petersi petersi Taylor

Fig. 50

Taylor (1968) recognized two subspecies; *petersi noblei* was shifted from its normal place following *petersi petersi* by an adamant editor who was alphabetically inclined. A good series of this form has been taken. The species is known to reach a length of 286.5 mm. The width in length is 21-23.6 times. The primary plus the secondary folds vary from about 269 to 316. It must seem that 47 is an extraordinary range in body folds. In many genera and species a variation of 15 primaries is not unusual. Since there are 3 or sometimes 4 secondaries associated with one primary in *Epicrionops*, this represents a variation more or less equal to that in most variable species

in number of primaries. Two specimens x-rayed show the presence of 78 and 81 vertebrae. The type has 282 folds, 29 of which are confined to the tail.

Scales appear first on the collars. Here and in the following folds there is a partial or a complete row of transversely widened scales. At the middle of the body there is a single row increasing to 3 rows in the posterior body folds. Some of the largest scales are 2.5 mm in their greatest dimension.

Epicrionops petersi noblei Taylor

Fig. 51

This form reaches a total length of 328 mm of which 23 mm are in the tail. The body width is contained in the length about 20.5 times. The total folds behind the collars are 309-316, of which about 28 are confined to the tail. There are 81 vertebrae. This first collar is narrow, the second twice as wide with 4 transverse grooves above marking 6 dorsal folds.

Scales begin on the collar, increasing to 3 rows in each posterior fold, the largest scales reaching 2.5 mm in their greatest dimension.

Family **Caeciliidae** Gray

Subfamily **Caeciliinae** Taylor

Genus **Caecilia** Linnaeus

Taylor (1968) recognized 25 species in this genus, all confined to northern South America. One form occurring in Panamá, *ochrocephala*, was formerly placed in the genus but this differs in having the eyesocket absent, the eye covered with bone. It has now been placed in the genus *Oscaecilia*.

Caecilia abitaguae Dunn

Figs. 52-53

This is one of the largest species of the Gymnophiona, reaching a known length of about 1300 mm and a body width of 22 mm. The width in the length varies in the specimens studied from about 43 to 59 times.

Superficially this form resembles several other species but may be identified by the following characters. In the palatal region the prevomeropalatine tooth series is much shorter and more widely separated from the premaxillary-maxillary series. The anterior teeth of three of the dental series have group loss and group replacement. The narial plugs on the tongue extend beyond the front median edge of the tongue. The total primary folds vary between 137 and 148, the secondaries vary from 0 to 5 (one specimen, KUMNH no. 119403 from the type-locality, lacks traces of secondaries; three other known specimens have 3 or 5 secondary folds). All except a

few of the primary dorsal folds are incomplete dorsally as well as ventrally. The exceptions are in the posterior part of the body. The splenial teeth are 2-2 or 3-3, the splenial ridge on which they are placed is relatively high.

Scales begin near the end of the first third of the body (about 45th fold). A few scattered scales are present, the scales small and transversely widened. This row does not become complete until the folds are complete. The posterior folds have only a single row, but the scales are larger, and still more or less transversely widened. Scales are at least vaguely salmon colored. The cavity in the fold is narrower longitudinally than in most caecilians, and the scales are relatively smaller than in most large species of *Caecilia*.

Caecilia albiventris Daudin

Figs. 9, 54

I am reasonably sure that this form should be recognized as distinct. It has long been placed in the synonymy of *Caecilia tentaculata*. It differs in color markings and, unlike *tentaculata*, has subdermal scales. There are other differences also.

The species reaches a length of more than 600 mm, and a body width of 18 mm in one female. The number of primaries is approximately 144, the secondary folds, 45-53. (The type-specimen was reported as having 147? primary and 45 secondary folds.) The form seems widespread, being known from Surinam, the presumed type-locality, to Ecuador, Perú and Bolivia.

The scales begin to appear near the middle of the body and soon a single overlapping row is present in each succeeding fold. The scales are very large. The squamulae appear to be arranged in an orderly fashion.

Caecilia antioquiaensis Taylor

Fig. 55

This species reaches a length of 686 mm. The vertebrae are 177, the primaries 171, and only 4 secondaries. The width is contained in the length about 50 times.

Anteriorly scales begin to appear in the 96th fold. The scales at first are relatively few and small. In the posterior part of the body there are 2 or 3 rows in each fold. The subdermal scales are numerous and the squamulae are proportionally larger than those on the scales in the folds.

Caecilia armata Dunn

This poorly described form is known from a single mutilated and partially desiccated specimen. The present length is about 370 (Dunn, 1942, gives 390 mm). There are 180 primary and 92 secondary folds.

I have not been able to study this specimen (Museu Nac. Brasil, no. 8320) but presume it was properly placed in this genus. It differs from other *Caecilia* in having the greatest number of secondaries, of which 12 are complete.

The type description states that "This remarkable form has the hind half of the body with bony scales and in that respect agrees with *C. dunni*." The character of the scales of *dunni* is typical of most caecilian scales.

Caecilia bokermanni Taylor

Fig. 56

This species reaches a known length of 527 mm, a body width of 10.2 mm. There are 192 primaries and 15 secondaries. The vertebrae are 198 in the type.

Scales are present only in the latter part of the body beginning in the primary folds, just in advance of the secondaries. A single scale row is present posteriorly in both primary and secondary folds. The fold cavities are relatively shallow and the scales are in separate pockets.

Caecilia crassisquama Taylor

Fig. 57

This high mountain species reaches a length of about 728 mm, the width of the body in the length about 66 times. There are 174 primaries but secondaries are completely lacking.

Scales are present in the last 5 or 6 folds in the terminal region but no subdermal scales are to be found. Compared with the scales of other caecilians these were small and seemingly inflexible. When dry they do not tend to curl up. They are thickened and seemingly bony in character. They may be somewhat biscuit-shaped or with a curved surface. These do not flatten when placed in liquid as is usual for caecilian scales. The squamulae are rather hard to discern.

Parker (1934) reports a specimen from 3250 ft. on the eastern slope of the Andes at Zamora, Loja, Ecuador which may be of this species. He states that scales are absent but they may have been overlooked as they are confined to the posteriormost folds.

Caecilia degenerata Dunn

Fig. 58

This species, confined so far as known to the central Colombian provinces of Cundinamarca and Boyaca (Atlantic drainage), is represented by a large number of specimens (62). The primary folds are known to vary from 123 to 137; there are normally no secondaries. The largest specimens reach a length of 555 mm.

This species varies in the presence or absence of scales in the folds. Nor-

mally they are absent but in several specimens presumably correctly identified, some scales are present and relatively well developed.

Caecilia disossea Taylor

Fig. 59

This is a very slender, elongate species; the body width in length varies from 54 times in young to 132 times in old specimens. Primary folds range from 216 to 252, secondaries from 16 to 34. The eye is in an open socket.

Scales appear in about the last third of the body. These are small, often somewhat curled up. Near the posterior part of the body there is usually only one complete row in each fold, the scales quadrangular to subcircular in shape.

Caecilia dunni Hershkovitz

Fig. 60

This species is known to reach a length of 464 mm, the width of the body about 14.1 mm. The species as treated by Dunn (1942) would appear to have included more than a single species (he himself suggested that it may be necessary to recognize more than one). Two of the specimens which are referred are types of Boulenger's species *Caecilia intermedia* described in 1913! (See Taylor, 1968, p. 381.)

Scales begin anteriorly at about the 48th primary. At first there are only a few scales, then a complete row. These increase posteriorly until there are 3 scale rows in each primary and secondary fold.

Caecilia flavopunctata Roze and Solano

Fig. 61

This form is known from a single type specimen, which measures 590 mm in length and has a body width of about 16 mm. There are 155 primary and 27 secondary folds, incomplete dorsally except in the last few centimeters of the length.

Scales anteriorly appear at about the 35th primary fold. At first there are a few scales, which form a single complete row farther back and so continue to the terminus. The scales are in separate pockets. Subdermal scales are present.

Caecilia gracilis Shaw

Figs. 62-63

This is probably the slenderest species in the genus in proportion to its length. It reaches a length of 475 mm with a body width of about 5 to 8 mm. It is widespread from French Guiana to Brasil and Perú. The primaries are known to vary from 183 to 204, the secondaries from 11 to 28

(Dunn reports 185-214; 9-25). The vertebrae in two specimens were 189 and 202.

Scales begin near the end of the body, preceding the few secondaries a short distance. There are two scale rows in the terminal folds.

The specimens from Iquitos appear to differ from those from French Guiana in the character of the squamulae and the position of the initium. It will be necessary to review all the specimens of this species as there is a likelihood that more than one form is represented.

Caecilia guntheri Dunn

This species reaches a length of 620 mm with a body width of about 20 mm. There are 119 primary folds and 9 or 10 secondaries present. Only a few of the primaries are complete.

Scales begin about the 26th fold and are in a single row in succeeding folds. One of the presumed paratypes is said by Dunn (1942) to have no scales; the other paratypes are scaled like the type. I have not studied the Dunn paratype specimens.

Caecilia leucocephala Taylor

Fig. 64

This presumably is a small species, the type measuring 189 mm with a body width of approximately 6 mm. There are 118 primaries and 42 secondaries.

Scales begin anteriorly at about the 15th primary fold. At first only a few lateral scales are present, but soon the single scale row is as long as the groove separating the folds. The scales are relatively large and strongly overlapping. Through much of the body there are numerous subdermal scales in the connective tissue below the skin.

I have recently examined a specimen (C.A.S. No. 66187) which purports to be from "Central Brasil." I consider the locality most doubtful. It measures 455 mm in length, the body width about 11 mm. It likewise has 118 primaries but only 32 secondaries, 9 of which are complete. Scales begin at about the 25th fold.

Caecilia nigricans Boulenger

Figs. 9, 65-66

This species, one of the largest in the order, reaches a known length of 1030 mm, with a body width of about 21 mm. The primary folds number from about 157 to 192 with a mean of about 170. Secondary folds are 32-69 with a mean of about 40. Vertebrae vary between 175 and 196. The species is presumably confined to the Pacific and Caribbean drainage of Ecuador, Colombia, and Panamá (Darién).

The range of variation in this large form strongly suggests the need for

a reexamination of the material. It is quite probable that more than a single species is involved which would in part account for the variation.

Scales are present beginning near the 40th primary fold. Anterior scales often have thickened concentric lines and are frequently notched. The posterior scales are the largest. They may reach a size of 4.5 mm in their greatest dimension. Those anteriorly situated are almost invariably transversely widened, the posterior ones becoming subquadrangular or with the longitudinal dimension greatest.

Caecilia occidentalis Taylor

Fig. 67

This species, originally described by Taylor (1968) from a defective specimen, was more adequately described by him in 1969(f). The relatively slender species reaches a known length of 1035 mm. The width in length varies from 52 to 111 times! (In the table of measurements, Taylor, 1969f, page 786, the numbers 663 and 1085 should read 66.3 and 108.5.) The primary folds are 191-221, the secondaries are from 0 (2 specimens) to 12.

Scales are in a single row in each fold in the latter two thirds of the body, but they begin farther forward, at about the 45th fold, with only 1 or 2 scales in a fold. Subdermal scales are present and vary in shape. Most, however, are subcircular.

Caecilia orientalis Taylor

This high mountain species (between 6000 and 6500 feet) is represented by a series of 33 specimens, the largest of which measures 464 mm. The vertebrae of two specimens are 120 and 128. The primary folds are 106-123 but no secondaries are present.

When present the scales are small and sparse, being present in separate, usually not contiguous, tissue pockets and being confined to the last few folds preceding the vent. No subdermal scales are to be found in the connective tissue. The forms with scales are chiefly from somewhat more northern localities than the others.

Caecilia pachynema Günther

Fig. 68

This species, so far as known to me, is confined to the Pacific drainage areas of Ecuador and Colombia. The coloration is distinctive in that there is a series of quadrangular yellowish or cream spots forming a lateral line from neck to vent. There are several species in the genus that have a dim unbroken stripe of light color on the side. In some forms it is easily discerned, in others this is not the case.

Dunn (1942) treated with this species certain specimens from the Atlantic drainage of Ecuador which may or may not belong here. The speci-

mens show a much greater range of variation than is usually regarded as specific. Dunn states that it reaches a higher altitude (6200 ft.) than other caecilians. One record, which he questions, is that of a specimen from 9274 ft. at Quito.

The primaries are known to vary from about 150 to 163 ± (Dunn states 154-199), the secondaries 0-11. The vertebrae in one specimen are 177, a specimen measuring 616 mm.

Scales are present or absent in the folds (*fide* Parker, 1934, and Dunn, 1942).

This material obviously needs further revision.

Caecilia perdita Taylor

Fig. 69

This species, known only from western Colombia, reaches a known length of 505 mm. The primary folds are widely incomplete dorsally, except on the last 9 cm of length. They are incomplete ventrally except for about the last 5.5 cm. The primaries are known to range from 132 to 152, the secondaries from 64 to 83. The width in length varies from 34 to 56 times. Two specimens have 155 vertebrae each.

Scales are present in the folds beginning at about the 25th primary. They are lateral on most of the body but arranged posteriorly in 5 rows where they may completely surround the body. Subdermal scales begin near the head and are widely distributed in the connective tissue. These are minute and nearly circular in shape.

Caecilia pressula Taylor

Figs. 7, 70

The group of six specimens upon which this species is based has been treated as *Caecilia tentaculata* in Dunn (1942). The largest specimen measures 437 mm; the body width is about 12.5 mm, the height of the body 17.2 mm, owing to the fact that the bodies are strongly compressed. The primaries are 113-119, the secondaries 27-37.

Scales anteriorly appear at about the 28th fold. These are 4-5 times as wide as long. At the middle of the body there are 6-8 scales in a row, variable in size. Posteriorly the scales are large and subquadrangular. I did not discover any subdermal scales.

Caecilia subdermalis Taylor

Figs. 71-72

This large form reaches a length of 750 mm, with a body width of 23 mm. The primary folds are 124, incomplete dorsally and about one-half complete ventrally; secondaries are completely lacking.

Scales are present in the terminal 30 primary folds. These are large, very irregular and confined to the sides and venter. Some of the scales have a tendency to form a roll, rather than being flattened. The individual squamulae are large and very irregular. Scales over the anterior area are much widened (3 to 4 times wider than long) and the squamulae do not form sharply defined rows. Many scales show what appear to be lines of growth.

Caecilia subnigricans Dunn

Fig. 73

This species is known from 3 specimens, 2 adults and 1 larva. The greatest known length is 375 mm, the body width in the adults about 6 mm. The primary folds are 158, 154, 152 ± for the three, the secondaries 18, 17, 31.

Scales in the adults are present first at about the 40th primary fold and soon form a single row in each fold. This number does not increase posteriorly.

Caecilia subterminalis Taylor

Fig. 74

This strongly striped Ecuadorean species, known from a single specimen, reaches a length of 436 mm and a body width of about 7.8 mm. There are 170 primary folds and 16 secondaries. None of the secondary folds are complete. The stripe, starting on the side of the head, covers the lower jaw and is well defined to the terminus, where it unites in front of the vent with the stripe from the opposite side.

Scales begin at about the 14th primary fold, the scales small, 2 or 3 on a side. They soon form a single scale row in each fold. The number does not increase posteriorly.

Caecilia tentaculata (Linnaeus)

Fig. 75

This, the oldest described species of Gymnophiona, is one of the largest species in this genus, reaching a known length of 1075 mm. The largest specimen that I have studied was 885 mm in length. The primaries usually are from about 112 to 130. This species seemingly has been confused with *Caecilia albiventris.* It differs in coloration and, unlike *tentaculata,* has many subdermal scales which appear to be completely lacking in *tentaculata.* It would also appear that *tentaculata* has fewer folds, primary and secondary combined, than *albiventris,** and a different color pattern.

The scales begin in the folds anteriorly at about the 20th primary, soon

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* I wish to thank Dr. William Duellman for obtaining for me a photograph of the type of *albiventris* now in the MNHN (Paris) Museum.

increasing to a single row in a fold, and continuing so to the terminus of the body.

Caecilia thompsoni Boulenger

Fig. 76

This is a very large species reaching a known length of 1,170 mm and a body diameter of about 13 mm. The primary annuli number 187 to about 207, the secondaries 29 to 45. The first and second collars are not invariably fused together dorsally as apparently obtains in the type.

Scales begin about the 50th primary fold. Anteriorly they are small and transversely widened. Throughout most of the body there is a single scale row in each primary and secondary fold. The scales anterior to the secondaries often have circular or irregular ridges. After the secondaries begin, the scales tend to become subcircular or quadrangular and strongly overlapping. The scales are large, the largest measuring about 4 mm in greatest dimension. Subdermal scales are widely distributed in the connective tissues under the skin. These are small and usually circular.

Caecilia volcani Taylor

Fig. 77

Caecilia volcani Taylor, Univ. Kansas Bull. Sci., vol. 48, no. 12, May 16, 1969, pp. 315-323, figs. 1-4 (type-locality, El Valle de Anton, Panamá).

This recently discovered species reaches a known length of 324 mm and a body width of about 8 mm. The primary folds vary between 112 and 124, the secondaries from 14 to 32. This species is uniformly slate-gray dorsally and laterally, and only a shade lighter on the venter. The tooth formula is approximately: premaxillary-maxillary, 9-9 to 12-12; prevomero-palatine, 9-9 to 11-11; dentary, 9-9 to 11-11; splenial, 2-2.

The scales begin to appear in the folds near the middle of the body, a few at first and then a single more or less complete row. The number of rows does not increase; in the posterior folds there is but a single row of strongly overlapping scales. The shape of the scales does change. Anteriorly they are transversely widened; farther back they become more elongate, while posteriorly they may be nearly square. This species also has a considerable number of subdermal scales. These usually measure from about 0.17 to 0.25 mm.

Genus **Oscaecilia** Taylor

Taylor recognized six species in this genus, *O. bassleri, O. ochracephala, O. polyzona, O. elongata, O. hypereumeces,* and *O. zweifeli.*

This genus differs from *Caecilia* in having the eye under bone, the skull lacking eye sockets.

Oscaecilia bassleri (Dunn)

Fig. 78

This species, characterized by its great length and slenderness, is known to reach a length of 975 mm. The width of the body is often contained in the length more than a hundred times. The vertebral count reaches 273.

Scales appear anteriorly at about the 18th primary. At first they are scattered. Farther back a single complete row is established, and this number is continued to the end of the body in the primary folds and secondary folds if the latter are complete. The scales are much the same size in a given row and are strongly overlapping, right to left and left to right with one or two median symmetrical scales. Usually it is possible to discern the fine tissue forming the individual pockets for the scales.

The squamulae are relatively large in this species. The initium is sometimes near the middle of the scale. Some of the largest scales measured were 2.8 × 3.1, 2.6 × 3.2 and 3.2 × 3.2 mm, these from the last centimeter of the body. These are especially large in proportion to the diameter of the body.

Oscaecilia elongata (Dunn)

This form is now known by a fragmentary specimen (head and a section of the anterior part of the body). The types (2 specimens) were lost or destroyed during World War II. The primaries were 226-231 and there were no secondaries. The eye was invisible and there were no markings. There is no absolute certainty that the fragmentary specimen actually belongs to this species.

Whether scales are present in the folds of the posterior part of the body is unknown. However, while the diagnosis states "no scales," the fragmentary paratype does have subdermal scales in the connective tissue.

Oscaecilia hypereumeces Taylor

There are two known specimens. The type measures 640 mm in length and has a body width of about 7 mm. The primary folds are 226, incomplete throughout the body except in the last 5 cm of length. There are but 4 secondaries, not continuous across the dorsum. In the second specimen there are 208 primaries, 21 secondaries. The length is approximately 400 mm. There are 214 vertebrae.

Scales begin near the middle of the body and continue to the terminus but with not more than a single row of scales in a fold and each scale in a separate pocket. The largest of these measures 1.9 to 2.7 mm in greatest dimension. There are, however, a great many subdermal scales in the connective tissue and these extend forward on the body to near the head.

It is indeed unfortunate that the second specimen is without a more exact locality than "Brasil."

Oscaecilia ochrocephala (Cope)

Fig. 79

This is the oldest described member of the genus. It is known to reach a length of 610 mm, the width in length varying greatly. The primary folds are from about 167 to 192; the secondaries vary from 7 to 29.

Scales appear at about the 24th primary fold. The anterior scales are diminutive, 0.1 to 0.5 mm, and few in a fold. Tracing posteriorly, they soon form one complete row, and this single row continues throughout the body. The scales become larger posteriorly, the largest measuring 1.6 to 2.2 mm in greatest dimension. The scales are often nearly quadrangular with a slight median elevation.

Oscaecilia polyzona (Fischer)

Figs. 6, 80

This form, which is known only from Antioquia, Colombia, reaches a length of 712 mm when stretched to eliminate the sinuosity of the spine (thus larger than Fischer's [1880] measurements). Taylor (1969a) names a cotype, ZMB no. 9524, the lectotype. The numbers of primary folds in the form are 206 to 210, the secondaries about 10 to 16.

Scales appear at about the 24th primary where they are very small and few in a fold. The row becomes complete before the middle of the body and continues with one scale row in each fold. The posterior scales are large, measuring 2.2 to 2.9 mm in greatest dimension. In a Vienna specimen (NMW 9141) the scales are externally visible in the edges of the folds. It is possible that this should be regarded a subspecies of *O. ochrocephala*.

Oscaecilia zweifeli Taylor

Fig. 81

The species has a white or whitish venter, the color reaching up laterally suggesting a white lateral stripe. A short light stripe is present on the side of the head. It is known from two specimens, both from the type-locality, which measure, respectively, 312 and 334 mm in length, the width in length 40 and 47 times. Vertebrae are 151, 153, primaries 147, 146, and secondaries, 17, 16.

Scales begin anteriorly at about the 92nd primary fold. The single scale row is complete at the beginning of the secondaries. This number continues to the end of the body in both primary and secondary folds.

Subfamily **Dermophiinae** Taylor

Genus **Copeotyphlinus** Taylor

This genus was proposed for a species described by Cope (1866). This type has been lost and no other specimen has been found. Various authors have placed the form in three different genera, but the description given by Cope does not warrant any such associations. Some have suggested that no such species exists, that otherwise more specimens would have been found. This is a very weak criterion since a relatively large number of species are known as yet only from the type-specimen, and in the case of *Rhinatrema bivittatum* with two co-types, no further specimens have been discovered in the past 130 years.

Copeotyphlinus syntremus (Cope)

The primary folds were recorded as 130 "annular folds," the secondary folds as about 40 "intermediate annuli."

Cope (1866, 1885) does not mention scales but the presence of secondaries practically assures their presence.

Genus **Cryptopsophis** Boulenger

Cryptopsophis Boulenger, Ann. Mag. Nat. Hist., ser. 5, vol. 12, 1883, p. 166 (type species of the genus, *Cryptopsophis multiplicatus* Boulenger=*Siphonops simus* Cope).

Cryptopsophis simus (Cope)

Fig. 82

This large-scaled species reaches a known length of 472 mm. Its nearest relationship is probably with the species of *Gymnopis* but it differs primarily in lacking the splenial dental series.

Scales begin about the 13th primary fold. At first the rows are incomplete. Near the middle of the body there are 3 rows, increased to 5 posteriorly. The scales are very large and relatively regular. The dorsal scales are usually somewhat larger than the lateral or ventral ones. Larger scales from the last two centimeters measure 2.5 × 3.0 mm, 2.3 × 3.0, 2.7 × 3.3, 3.5 × 3.6, the largest, 3.6 × 4.0 and 3.5 × 4.0 mm. The initium is near the center of the scale.

Genus **Brasilotyphlus** Taylor

Only a single species of the genus known.

Brasilotyphlus braziliensis (Dunn)

Fig. 83

This diminutive species, reaching a known length of approximately 260 mm, has dental characters that suggest relationship to the African genus

Boulengerula. The latter species, however, lacks scales. The species is known from only four specimens, all from the type locality, Manaus, Brasil.

In *Brasilotyphlus* the scales begin to appear at about the 25th fold and continue to the end of the body. At first only a few scales are present. Near the middle of the body there are 2 complete or nearly complete rows. In the last few centimeters of the body the number is increased to 4 irregular rows in the median dorsal portion of the fold, while dorsolaterally there are usually 5 rows, with other occasional scales. They are usually less than a millimeter in any dimension, and are of such a nature that the light does not penetrate the scale so as to show well the characteristic patterns of the squamulae.

Genus **Dermophis** Peters

The type of the genus was designated by Noble (1924, p. 305). Taylor (1968) recognizes 11 forms under 10 species. Their distribution is confined to Mexico and Central America.

There is a strong possibility that one described form, *septentrionalis,* purporting to have been found in Brazil, is an anomalous specimen of *mexicanus,* and it has been placed in the synonymy of that species.

Dermophis balboai Taylor

Figs. 84-85

This medium-sized species is known to reach a length of 274 mm, the width of the body contained in the length 21-24 times. The primary folds vary between 89 and 91; the secondaries, 41-45. The species is ivory white on the venter.

Scales first appear at about the 30th fold. Back farther where the secondaries arise there are 2 or 3 scale rows in each primary fold. This number of rows increases to 8 posteriorly, and they are likewise present in the secondary folds. Scales of this species are as large as those occurring in *Dermophis mexicanus,* a larger species.

Dermophis costaricense Taylor

Fig. 86

The greatest known length of a specimen of this species is 387 mm (19 specimens); the width in length of the larger specimens (above 300 mm) is from about 28 to 33 times. The primaries are 110-117, the secondaries 80-96.

Scales begin to appear anteriorly at about the 18th fold. They increase from 1 scale row in a fold to 5 in the posterior part of the body. The scales are relatively large. Certain of those in the last centimeter of the type measure 1.6 × 1.9, 1.3 × 1.9, 1.5 × 1.9, and 1.5 × 2.0 mm.

Dermophis eburatus Taylor

This species is based on one Nicaraguan specimen, the type, and one young paratype from Volcán, Isalco, Salvador. The type, the largest specimen, measures 330 mm in length, the width in length 17.4 times. The primary folds are 107-112, the secondaries 67-70. It is perhaps a subspecies of *mexicanus*.

Anteriorly the scales are present in the 12th primary fold on the sides. They increase in number posteriorly on the body, near and at the middle there being 4 scale rows dorsally (fewer across the venter). In the folds on the last three centimeters of the body there are 4 scale rows. The scales are relatively large and many are irregular in shape (as happens in many forms).

Dermophis glandulosus Taylor

Fig. 87

This small species, still known from very few specimens, reaches a known length of 255 mm. The primary folds of the species are 93-99, and the secondaries are 37-46.

Scales appear a little anterior to the middle of the body and in the last few folds there are usually 2 or 3 scale rows in each fold.

Dermophis gracilior (Günther)

Fig. 88

This species is presumably a mountain form, being known from an elevation of 4000 feet. Only three specimens are known to me, all from western Panamá. The specimen listed by Dunn (1942) from Pozo Azul, Costa Rica seemingly belongs to another species.

D. gracilior reaches a known length of 345 mm. The body width in the length is 25-31 times. The primary folds are 91-98; the secondaries 68-78 (my counts). The coloration is somewhat plumbeous above, and yellowish or whitish below, but lacking the blackish marks on the edges of the folds as in the *mexicanus* group. The head tends toward yellowish olive.

Scales begin to appear at about the 13th fold where there are a few scattered scales to be found. Near the middle of the body there are at least 2 rows, increasing to 5 in each fold in the posterior part of the body. In Figure 88 it will be noted that the initium is near the center of the largest scale and the squamulae are relatively small and peripherally seemingly not clearly defined individually.

Dermophis mexicanus mexicanus (Duméril and Bibron)

Fig. 89

This is the best known species of the genus. It reaches a known length of 600 mm. It may readily be recognized by the well-defined blackish

borders of the folds, which are especially well marked on the venter. These markings are distinct on the other recognized subspecies, *D. m. clarkii*, too. The primary folds vary from 101 to 112, the secondaries from 51 to 79, the vertebrae from 109 to 113.

Scales appear laterally immediately behind the collars. The number of scale rows in a fold increases to 3 in the posterior primary and secondary folds.

The species described by Taylor (1968) as *septentrionalis*, from a specimen that purports to come from Brasil, is well-marked with dark transverse marks on the edge of the folds. I now regard this as a probably mislabeled specimen, and the other differential characters as being anomalous. Only one species of the genus is known to enter South America beyond Panamá.

Dermophis mexicanus clarkii (Barbour)

Fig. 90

This subspecific form differs from *D. m. mexicanus* in having a lower count of secondary folds (41 compared with 51-79). The form reaches a length of 420 mm. The primary folds are 104-105.

Scales begin about the 14th fold and increase to 2 rows in a fold throughout much of the body. In the posteriormost folds there are 2 well-defined rows with a third row underneath the other two, and with a few scattered scales. The largest scales are equally as large as those of *D. m. mexicanus*.

Dermophis oaxacae (Mertens)

Fig. 91

This species has usually been associated with the genus *Gymnopis*. However, it differs from that genus in having the eye in a socket (not bone-covered) and it lacks the set of splenial teeth. Proportional to the primary folds, it has the largest number of secondary folds in the Western Hemisphere Gymnophionians.

Scales are present near the collars in an incomplete row. At the middle the number of scale rows in a fold has increased to 6, which number continues to the end of the body. The largest scale measured is 1.6 × 1.6 mm. The scales are smaller and transversely widened anteriorly. Posteriorly they are larger and proportionally longer. The initium is usually near the scale center.

Dermophis occidentalis Taylor

Fig. 92

This small species is known to reach a length of 204 mm, the width contained in body length 30-32 times; primary folds, 111-112, the secondaries, 29-37. The three type-specimens were found under small rocks in an open meadow in relatively dry soil.

Scales appear anteriorly at approximately the 50th primary and are small and transversely widened. They gradually increase in size and number of rows in the folds. Posteriorly there are 4 rows. The largest ones measure about 1.0 mm.

Dermophis parviceps (Dunn)

Fig. 93

This is a small species, the type, measuring only 180 mm, contained embryos. The known maximum size is 217 mm. The width of the body in the length varies between 22.5 and 27. There are 93-100 primary folds and 13-25 secondaries, the smallest number being in the Panamanian type. Three other specimens known are from Cartago Prov., Costa Rica.

Scales anteriorly are present at about the 49th fold. At the point where the first secondaries appear there are 2 scale rows in each primary fold. In the terminal centimeters of the body there are 4 scale rows in both primary and secondary folds. The scales are as usual smaller anteriorly and tend to be transversely widened. Posteriorly they are larger, often tending to be subcircular.

Note that the individual squamulae are a little larger on the average than in *D. occidentalis,* a species comparable in size. It differs from that species in having fewer secondaries (29-37 in *occidentalis*) and somewhat fewer primaries (111-112 in *occidentalis*). Thus there is a difference of about 30 (combined) primary and secondary folds.

Genus **Gymnopis** Peters

Only three forms are recognized as belonging in this genus, all characterized by the absence of an eye socket, the eye being covered by bone. Formerly a number of other forms now placed in other genera were associated.

There may be a legitimate question as to whether three forms, *G. multiplicata, G. proxima* and *G. oligosoma* should be regarded as species or as three subspecies of *multiplicata.* They are treated here as subspecies.

In this genus the scales are numerous, both in the number of scale rows in each fold and in the body area so covered. The scales are present throughout from near the collars. It is possible that this makes them less restricted to wet muddy habitats. They are frequently found above the surface of the earth under logs, piles of rocks or trash, perhaps at a considerable distance from a wet muddy habitat.

Gymnopis multiplicata multiplicata Peters

Fig. 94

This form, at least in its northern range, is in the Pacific drainage area. It is known to reach a length of 397 mm. The body is relatively thick, the

width in length in large specimens 23-27 times; in younger specimens, about 30-33 times.

The number of primary folds is known to range from 119 to 133, the secondaries from 97 to 117. The splenial teeth are 1-1 and as far as known invariably present. The young are born alive with a length of about 140 mm.

Scales begin as far forward as the 13th fold but this point may vary somewhat. The anterior scales are small and do not cross the back at first. All are transversely widened. Near the middle the number is increased to about 5 scale rows in each fold, primary or secondary. Posteriorly the number is increased to at least 6 rows and these will be complete if the folds are complete. Posteriorly the scales are significantly larger.

In this subspecies the squamulae are distinctly larger than in *G. m. proxima* or *G. m. oligozona,* and the initium is nearer the anterior edge of the scale.

Gymnopis multiplicata oligozona (Cope)

Fig. 95

Of the type-specimens Cope (1877) states "the precise habitat of the species is uncertain." It is now known from Finca El Volcán, Alta Verapaz, Guatemala. Three other Guatemaltecan specimens are in the Musee d'Histoire Naturelle, Bâle, Switzerland, without specific locality.

The species is relatively small, reaching a known length of 300 mm. The body width is contained in the length 50 times in the largest known specimen. The known number of primary folds ranges from 128 to 131, the secondaries from 13 to 24.

A few scales begin at about the 10th primary fold. About 4 rows are present at the middle, increasing to 6 in the posterior folds. The scales are moderately large.

Gymnopis multiplicata proxima (Cope)

Fig. 96

This species, which ranges from Nicaragua to Panamá, is confined largely if not wholly to the Caribbean drainage system. The largest specimen known reaches a length of 473 mm. The primaries vary between 110 and 124; the secondaries between 90-107, with sometimes as many as 15 being complete. The splenials normally are 1-1. At birth a very specialized embryonic dentition is present on the lower jaw, a character also present in at least certain other forms of the genus.

Scales are found at or near the 15th primary fold where only 1 or 2 scales are present laterally on each side of the fold. At the middle the number in

each fold is 4 rows, while posteriorly there are normally 5 rows in each fold.

It will be noticed that the edges of the two lower scales in Figure 96 are folded over. Ordinarily a scale if curled up flattens out when placed in liquid. The scales of this specimen appear reluctant to flatten out.

Genus **Microcaecilia** Taylor

The present content of this genus has a varied history. *M. albiceps* was described in the genus *Dermophis*, later transferred to *Gymnopis*. *M. unicolor* was described as a *Rhinatrema*, later placed in *Gymnopis*. *M. rabei* was described in *Gymnopis*. The fourth species, recently described by Taylor (1969c), was placed as a member of the present genus.

This genus ranges chiefly in northern South America, one species only purports to be from Brasil.

Microcaecilia albiceps (Boulenger)

Fig. 97

This is the best known species of the genus and, so far as collections show, is confined to the Atlantic drainage of Ecuador. The body is known to reach a length of 227 mm, the width contained in the length 30-45 times. The primary folds are 115-123, the secondaries 50-62.

Scales are present as far forward as the 11th primary fold. These are very small, 2 or 3 scales in each side of the fold. At the middle of the body there is at least 1 complete row with some scattered scales. Throughout much of the posterior part of the body there are 4 scale rows in each fold and in the terminal folds there may be as many as 6 rows.

The scales appear to have the initium close to the center of the scale. The arrangement of the squamulae suggests that in *M. supernumeraria* in some of those scales figured, while in others it suggests that of the other two species of the genus.

Microcaecilia rabei (Roze and Solano)

Fig. 98

This species is known from 5 specimens—the two longest being only 185 mm in length. The width of body is contained in the length about 40 times in the largest specimen. The primary folds vary between 107 and 116, the secondaries 21-34.

The scales first appear at about the beginning of the secondaries (86th primary fold). At first a few scattered scales are present. At about the 6th secondary there is usually a complete row. They increase in number of rows in a fold to 4 or 5 posteriorly.

Microcaecilia supernumeraria Taylor

Figs. 99-100

Microcaecilia supernumeraria Taylor, Univ. Kansas Sci. Bull., vol. 48, no. 11, May 16, 1969, pp. 307-313, figs. 1-4 (type-locality, "São Paulo, Brasil").

This form, known from a single specimen purporting to be from São Paulo, Brasil, reaches a known length of 258 mm. The body width is contained in the length approximately 42 times. The eye, if present, is covered by bone. The splenial teeth are absent.

The number of scales of this recently described form exceeds that in the other species of the genus. The scales begin in the first primary fold and seemingly surround the neck at the fourth fold. They increase in number of rows in each fold to 5 or 6 throughout the major part of the body. Posteriorly some of the rows in the folds are exposed (Fig. 100a, b, c). In Figure 99 note that the squamulae on the scales tend to form radiating lines from the initium.

Besides the scales in the primary and secondary folds, there are very numerous small subdermal scales in various layers of connective tissue below the skin (Fig. 100d). Scales of this type occur in several species of the genus *Caecilia* and would appear to be absent in others. I believe that they may be absent in some other forms placed in this genus, but are definitely present in *M. albiceps*. The subdermal scales are minute, usually about 0.20 to 0.25 mm in greatest measurement. They are usually still smaller in *M. albiceps* —0.1 to 0.2 mm.

Microcaecilia unicolor (A. Duméril)

Fig. 101

This species, still known from very few specimens, reaches a known length of 235 mm. In specimens from French Guiana primary folds are 106-118; the secondary folds 56-74; or combined folds of 167-182. I have referred a specimen from Guyana to this species with some hesitancy and used its description in Taylor (1968). It differs in several ways. There are only 97 primaries and 46 secondaries, a total of 143. The premaxillary-maxillary tooth series of the Guyana specimen is nearly double the number from the other locality. More material may warrant a revision of this treatment.

Scales appear at about the 20th primary fold, forming an incomplete row. At the point where secondaries appear there are 4 rows of scales; in the last 3 centimeters of the body there are 7 or 8 rows in each primary and secondary fold. The anterior scales are very small, about 0.2-0.45, in greatest measurement. Posteriorly they are often twice as large in each dimension. It may be noted (Fig. 101) that the squamulae are quadrangular, often square, but not arranged in radiating rows as in *M. albiceps*.

Genus **Parvicaecilia** Taylor

The genus *Parvicaecilia* differs primarily from the genus *Microcaecilia* in having the eye in an open socket that connects and is continuous with the tentacular groove.

There are two species that have been referred to this genus, *P. nicefori* and *P. pricei*. These are diminutive forms, neither known to reach a length greater than 263 mm.

Parvicaecilia nicefori (Barbour)

Fig. 102

This species reaches a known length of 263 mm, the body width in length 46-55 times. It differs widely from *pricei* in having a much larger number of primary folds (130-166) as well as a larger number of secondaries (98-111). Both species are seemingly confined to Colombia in the Caribbean drainage area.

The scales appear near the 29th fold and at the middle of the body there is a single scale row with some scattered scales in each fold. Towards the posterior end of the body the number increases to at least 4 rows in each primary and secondary fold. The anterior scales are small, increasing in size posteriorly. Figure 102 shows considerable irregularity in the distribution and shape of the squamulae. The scales themselves are more nearly circular than are scales in *pricei*.

Parvicaecilia pricei (Dunn)

Fig. 103

This species is known to reach a length of 191 mm, the width in length between 30 and 34 times. The primary folds are 106 in the type, the secondaries 26.

Scales begin at about the 21st primary fold. At the middle of the body there is a single row. The number increases to 4 rows in the posterior folds. All scales seem to have their transverse dimension largest. The initium is somewhat anterior to the geographic center of the scale and the distribution of the squamulae is orderly in curved series.

Genus **Idiocranium** Parker

Only a single species of this distinctive genus is known. It is confined to Eastern Nigeria and the Cameroons in Africa.

Idiocranium russeli Parker

Fig. 104

The scales in this diminutive species are present only in the posterior part of the body. They are to be found first laterally near the beginning of

the secondary folds. At first only one or a few small scales are evident in the primaries. Farther back the scales form 2 or 3 rows in each of the primary and secondary folds. In the folds preceding the vent level there may be 4 or 5, not all of which may cross the venter.

The scales increase in size from fore to aft; the anteriormost are usually smallest and they may not even be contiguous with each other. Five of the largest scales taken from BMNH no. 1946.9.573 and EHT-HMS no. 4687 measure, respectively, 1.1 × 1.55, 1.05 × 1.4, 1.05 × 1.2, 1.4 × 1.6 and 1.0 × 1.5 mm. The individual squamulae surrounding the initium are of nearly the same size, with the peripheral squamulae somewhat smaller.

Since the skull characters of this genus differ greatly from those of other genera in this family, one might expect greater differences in squamation than actually obtain.

Genus **Schistometopum** Parker

Parker (1941) recognized two forms as species, *S. gregorii* and *S. thomense*. Taylor (1968) recognized two others, a presumed new form, *S. ephele*, and *Siphonops brevirostris* of Peters.

Schistometopum brevirostre (Peters)

This bluish gray species with a light-colored head, presumably a mainland form, differs from *thomense* in having a totally different color and a larger average number of body folds.

Scales are to be found first in the 20th fold. At the middle of the body the row of scales is still incomplete dorsally. After the secondaries begin, the rows become complete. Posteriorly there are 4 rows in each fold. The largest scales found posteriorly measure 1.0 × 1.3 and 1.2 × 1.75 mm.

Schistometopum ephele Taylor

Fig. 105

This form was originally described on the character of a diminutive head, a color pattern differing from *Schistometopum thomense*, and the fact that it was a mountain form. A larger amount of material may prove this as being worthy only of subspecific relationship.

There are 97-106 primary folds; the secondaries are 50-52. The largest specimen examined measured 366 mm. The body width in length is approximately 24 times.

Scales begin to appear at about the 33rd fold, at the beginning of the secondaries. Here there is 1 complete row around the body. Posteriorly 3 scale rows are present in each fold.

Schistometopum gregorii (Boulenger)

This well-known species reaches a known length of 355 (363?) mm, the width in the length in large specimens (above 300 mm) is 27-39 times. The number of primary folds usually varies between 111 and 117, the secondaries between 36 and 51 in the northern area of Kenya. In the southern part and in Tanzania the primaries are much the same but the secondaries are further reduced (16-36).

Scales are found forward at about the 45th primary fold. These increase posteriorly to 4 rows throughout much of the body. The larger scales from the last cm of a large specimen measured 1.2 × 1.2, 1.2 × 1.3, and 1.1 × 1.2 mm.

Schistometopum thomense (Barboza du Bocage)

Fig. 106

This bright yellow island species reaches a known length of 283 mm. The width in length is about 20 times, though in smaller specimens it may be nearly double this (39 times). The primaries range 93-103; the secondaries, 25-35 (one specimen has a count of only 17).

Anteriorly scales usually may be first found between the 20th and 25th folds. One scale row is nearly or entirely complete at the middle of the body, while there are 4 scale rows in folds at the posterior part of the body.

Genus **Herpele** Peters

Taylor (1968) recognized only two species in the genus, *H. squalostoma* and *H. multiplicata*. Other forms formerly placed in *Herpele* were placed in other genera—*H. bornmuelleri* in *Scolecomorphus*, *H. fulleri* in *Gegeneophis*, and *H. ochrocephala* in *Oscaecilia*.

Herpele multiplicata Nieden

I have not examined this type. Presumably it was formerly in the Berlin Museum but is now lost. On the basis of Nieden's (1912) description, I regard it as a legitimate species. However, there is some uncertainty as to whether it is a member of this genus since the description omits mention of certain pertinent characters. Even the presence of scales is presumed since they are not mentioned in the description.

Herpele squalostoma (Stutchbury)

Fig. 107

The type is presumably lost. The species, however, is well represented in collections. It is a large species, known to reach a length of 565 mm. Two thirds of the specimens examined measured more than 400 mm. The counts

of vertebrae in three specimens were 123, 131, 133. Primary annulae vary between 118 and 129; usually the number of secondaries is between 21 and 30. In living forms the head is pinkish.

Scales are to be found first at about the 36th anterior fold. These increase to 4 rows posteriorly. The largest measure 1.4 × 1.7, 1.4 × 2.1, 1.5 × 2.2, and 1.5 × 2.4 mm.

Genus **Uraeotyphlus** Peters

Taylor (1968) recognized four forms in this genus. He was somewhat uncertain whether the genus should be regarded a member of the Ichthyophiidae or the Caeciliidae. Even after examining skulls he still finds that there may be a question of its proper placing.

Uraeotyphlus malabaricus (Beddome)

Fig. 108

This form is known to reach a length of 234 mm, the width in length about 26 times (the known variation, 20-28 times). The primary and secondary folds are in equal or nearly equal numbers. In five specimens studied, the range for primary folds was 116-123, and exactly the same for secondaries. (In Taylor, 1968, page 699, the type number in the table should read 74.4.29. 181 instead of 94.4. 29. 181.)

Scales were found in the second quarter of the body. At first they are minute and only a few in a fold. At the middle there is usually 1 complete row. In the posterior part of the body there are 4 rows with occasionally some scattered scales.

Uraeotyphlus menoni Annandale

Fig. 109

The species reaches a length of at least 245 mm with primary folds about 92 and secondaries 80-84. There are 98 or 99 vertebra present in one specimen.

Scales appear at about the 11th fold. At the middle of the body there are 3 to 4 scale rows, increasing to 6 in the posterior primary and secondary folds.

Uraeotyphlus narayani Seshachar

Fig. 110

This species reaches a known length of 237 mm, the width in length about 21 to 23 times. The primary folds are about 92 to 96, the secondaries, 77-83. The type-specimen has 104 vertebrae.

Anteriorly a few scales are present in the 16th primary fold. These increase in number of scales and scale rows so that 4 is the usual number of

rows in folds in the posterior part of the body. The scales tend to be cycloid or slightly wider than long.

Uraeotyphlus oxyurus (Duméril and Bibron)

Fig. 111

This, the oldest described and best known species of the genus, reaches a length of 300 mm, the width in length about 21 times. The primaries of 13 specimens studied varied from 98 to 107, the secondaries from 92 to 104.

Scales appear anteriorly in the 10th primary fold. At the middle of the body the number of rows in each fold has risen to 5 in the dorsal midline of the fold, but to fewer laterally and ventrally. Posteriorly on the body there are usually 7 rows in each fold with some extra scales also present.

Genus **Geotrypetes** Peters

Taylor (1968) recognized 5 forms under 4 species: *Geotrypetes congoensis, G. angeli, G. pseudoangeli, G. seraphini seraphini* and *G. seraphini occidentalis*. A fifth species was added by Taylor (1970b)—*G. grandisonae* from the mountains of Ethiopia.

Geotrypetes angeli Parker

Fig. 112

This species reaches a known length of about 234 mm. The width is contained in the length about 28.5 times. The primary folds of the holotype are about 105, the secondaries 33 or 34. Vertebrae of the holotype are 107. The body color is brown with yellowish below.

The scales appear anteriorly about 2 cm preceding the first secondaries. They increase in number posteriorly to 4 rows in each fold. The rows are arranged almost completely one above the other.

Geotrypetes congoensis Taylor

Fig. 113

A considerable number of specimens of this species were studied, none of which reached a length greater than 238 mm. Only a part of the Congo specimens in the collection were studied and it is possible that I have not seen the largest specimens. The primaries range from 87 to 98 with a mean of 90.7; the secondaries from 30 to 45, the mean 36. The width in length varies from approximately 25 to 35 times.

Scales begin anteriorly at about the 20th fold. There are 2 or 3 rows in each fold in the middle of the body, but they do not cross the dorsum since the folds themselves are incomplete. Posteriorly there are 6 or 7 rows in each fold, most of which surround the body.

Geotrypetes grandisonae Taylor

Figs. 1, 114

Geotrypetes grandisonae Taylor, Univ. Kansas Sci. Bull., vol. 48, no. 23, May 1, 1970, pp. 849-854, figs. 1-4 (type-locality, Aleku 12 km N Dembidollo, Ethiopia, 1846 m elev.).

This mountain species, of which only two specimens are known, reaches a length of 259 mm (type). The width in length of the type and paratype is approximately 24 and 20.6 times. The primary folds are 84, 85; the secondaries 69 (33 complete), 72 (32 complete).

Scales are first found at about the 15th primary fold. At the middle of the body one finds 2 to 3 in each primary fold. Posteriorly there are 4 or 5 scale rows in each primary and secondary fold. Anteriorly the scales seem to be absent in some of the first secondaries.

Geotrypetes pseudoangeli Taylor

Figs. 8, 115

This specimen has been separated from *Geotrypetes angeli* Parker. It is known to reach a length of 234 mm; the width in length varies from 26 to 29 times. The primary folds are 99-101, the secondary folds 28-33 in four specimens. The first collar is not or scarcely separated or differentiated from the occipital region. The color is blue-gray above and beneath, banded at each groove with white.

Scales appear at about the 30th primary fold. At the middle of the body there are usually 3 scale rows in each fold, while posteriorly there are 6 or 7 complete or partial rows in each fold. It will be seen that the number of scale rows is greater than in *G. angeli*.

Geotrypetes seraphini seraphini (A. Duméril)

Fig. 116

This form reaches a length of 309 mm, the width in length approximately 20-27 times. The primary folds vary from about 94 to 100, the secondaries from 32 to 50.

The scales appear anteriorly at about the 33rd primary fold. In the middle area there is usually 1 scale row in each fold (laterally at least, since not all the folds are complete dorsally); posteriorly the folds are complete with 4 scale rows in each fold.

Geotrypetes seraphini occidentalis Parker

Figs. 117-118

The form is known to reach a length of 320 mm. The width in length varies from about 19 to 26 times. The primaries are usually in the range of 89 to 104, the secondaries from 48 to 58.

Scales begin anteriorly at about the 45th fold. Near the middle there are 4 rows in each fold; more posteriorly there are 7-9 rows in each fold.

Genus **Gegeneophis** Peters

Taylor (1968) has referred three species to this genus, *G. carnosus* Beddome, *G. ramaswamii* Taylor and *G. fulleri* (Alcock). Taylor had examined the type of *fulleri* superficially and placed it in this genus with some reluctance. It will bear careful re-examination before it can be certainly placed generically.

Gegeneophis carnosus (Beddome)

Fig. 119

This diminutive species reaches a known length of 172 mm. The width is contained in the length about 35 times. The primary folds are 105-112, the secondaries about 7 to 13. In life this species is pink or flesh color.

Scales are present anteriorly beginning in the two primary folds preceding the secondaries. There is but a single complete (or incomplete) row in each primary and secondary fold following this.

Gegeneophis fulleri (Alcock)

This species, known from only the single type, has 92 primary and 13 secondary folds. The diameter of the neck is about 5 mm, while that of the terminal region is 9 mm. This widening of the terminal region is also characteristic of *G. ramaswamii* but seemingly not true of *G. carnosus.*

Scales seemingly are confined to the last third of the body, beginning at about the 70th fold, some ten folds preceding the first secondaries. I was unable to study and measure the scales of this type specimen for lack of an adequate microscope and photographic equipment (see Taylor, 1968, p. 935).

Gegeneophis ramaswamii Taylor

Fig. 120

This, the largest species of the genus, reaches a length of 340 mm, but all specimens examined (18) save two were less than 300 mm in length. The body of the species increases in diameter gradually and becomes widest at the terminus. There are 95-104 primary folds and 8-14 secondary folds.

The scales begin in the body near the 85th primary fold, where 2 or 3 scales are to be found. Scales increase posteriorly to about 4 rows in each primary and secondary fold.

Genus **Indotyphlus** Taylor

Only a single species is recognized in the genus.

Indotyphlus battersbyi Taylor

Fig. 121

This species is known to reach a length of 238 mm and a body width of 4.9 mm. The primary folds vary in number from 130 to 141, the secondaries from 17 to 29 of which 13 are complete. Vertebrae range from 138 to 144.

Scales begin shortly in front of the first secondary fold. The number of scales and the number of rows in each fold increase so that most folds have 3 scale rows. The scales are variable in size and small. Those farthest forward measure about 0.35 × 0.55 mm. The largest posterior scales measured were about 0.65 × 0.8 mm.

Genus **Grandisonia** Taylor

Taylor (1968) recognized five species in this genus. *Grandisonia alternans, G. sechellensis,* and *G. larvatus* are three closely related species. Two species, *G. brevis* and *G. diminutiva,* were recognized here with some doubt. These two, perhaps the two smallest species in the Order, are known from two specimens each. Nothing is known of their life histories or their skull characters. Each has a tail remnant with at least one complete fold posterior to the vent. With more material studied it may be necessary to place them in a different genus.

Grandisonia alternans (Stejneger)

Fig. 122

This well-known species reaches a length of 318 mm, the width in length about 19 times in the type. The primary folds are known to vary from 76 to 88, the secondaries from 72 to 85. The ratio of secondary folds to primaries is greater in this species than in other species of the genus except *sechellensis.*

Scales begin to appear anteriorly near the collars (6 or 7th fold). Near the middle of the body there are 2 or 3 scale rows in each fold, posteriorly there are 6 or 7 rows in each.

Grandisonia brevis (Boulenger)

Two specimens are known, the lectotype and a cotype, measuring 112 and 40 mm respectively; the primaries are 66-68, the secondaries 59-60, the vertebrae 67-68. The width in length is approximately 14 times in the type. They have one or two folds behind the vent, so perhaps these forms should be regarded as having tails!

Scales begin in the folds preceding the secondaries, their size being 0.1-0.3 mm in greatest dimension. Posteriorly there are 2 rows in each fold, the largest scales 0.5-0.8 mm in greatest dimension.

Grandisonia diminutiva Taylor

Fig. 123

This species is known from only 2 specimens, a type and paratype. They measure respectively 95 and 64 mm in length. The primary folds are 83 and 80; the secondary folds are 64 and 68, of which 35 and 33 are complete about the body.

Scales begin near the first secondaries; posteriorly there are 2 scale rows in the folds at the middle of the body, while in most of the latter half of the body there are 3 rows in each primary and secondary fold. The scales are small, transversely widened, and rarely reach 1 mm in the greatest dimension.

Grandisonia larvata (Ahl)

Fig. 124

Parker (1958), who was able to study the larval type of this species, has concluded that his own *G. angusticeps* is the adult of the species. I have accepted this interpretation. The species reaches a length of 202 mm. Primary folds vary from 78 to 82, the secondaries from 66 to 80.

I was not able to study the species in sufficient detail to ascertain its scale distribution.

Grandisonia sechellensis (Boulenger)

I have examined 6 specimens from Mahé and Silhouette. They vary in length from 135 to 175 mm. The primaries are 81-84, the secondaries 67-82 (in some cases the primaries and secondaries are equal in number!).

Scales are present anteriorly at about the 23rd primary fold. At the middle there are 3 scale rows in each fold, and these so continue to the end of the body.

Genus **Praslinia** Boulenger

This genus differs from all other known caecilian genera in having practically double the number of teeth in each series as may occur in other known species of the Order. Only a single species is recognized.

Praslinia cooperi Boulenger

Fig. 125

This small species (reaching 230 mm in length) is confined so far as known to certain islands in the Seychelles (Praslin and Mahé).

The scales begin to appear in the 14th to 20th folds. At first there are but a few scattered ones. At the middle of the body there are 3 rows; posteriorly there are 5 to 6 rows in each fold.

An examination of Figure 125 will show that the squamulae on the

scales tend to form relatively regular rows that radiate from the central initium as well as assuming the more conventional arrangement of semi-concentric series. The other genera occurring in the Seychelles, *Hypogeophis* and *Grandisonia,* do not show the squamulae arranged in radiating lines but follow the more usual arrangement of the squamulae in curved series.

Genus **Hypogeophis** Peters

Taylor (1968) recognized a single species with three subspecies. In 1969a he added a fourth subspecies, *H. rostratus lionneti,* from the "Seychelles." The entire genus so far as known is confined to the Seychelles.

Hypogeophis rostratus rostratus (Cuvier)

Fig. 126

The largest known specimen is 365 mm in length. The primary folds are known to range from 96 to 100, the secondaries from 4 to 20.

Scales begin a little anterior to the appearance of the first secondary. These increase to 2 complete rows in the posterior folds. The scales are small, rarely measuring 1 mm in greatest dimension. All are transversely widened.

Hypogeophis rostratus guentheri Boulenger

This subspecies is known to reach a length of 298 mm; the width in length approximately 23 times. There are 94 primaries and 8 secondaries.

Anteriorly scales are present first at about the 25th primary fold. There are two rows in each fold at the middle and this number continues to the end of the body.

Hypogeophis rostratus praslini Parker

Fig. 127

This form is known to reach a length of 295 mm, with a body width of approximately 10.6 mm. The primary folds range from 99 to 104, the secondaries from 5 to 26.

Scales begin at about the 25th primary fold and increase to 2 rows posteriorly, more rarely 3. The anterior scales are very small (0.2 to 0.5 mm in greatest dimension), the posterior ones rarely reach a 1 mm dimension.

Hypogeophis rostratus lionetti Taylor

Hypogeophis rostratus lionetti Taylor, Univ. Kansas Sci. Bull., vol. 48, no. 9, May 16, 1969, pp. 287-290, fig. 4 (type-locality, Seychelles).

This species is still known only from the type. It measures 252 mm in length. The width of the body is contained in the length approximately 20

times. There are 120 primary folds and 48 secondaries. This latter number is double the number of secondaries in the other subspecies.

Scales first appear at about the 20th fold. Anteriorly there are 2 scale rows in each fold, posteriorly there are 4 or 5 rows.

DISCUSSION

Family **Ichthyophiidae**

The family Ichthyophiidae has four recognized genera, *Rhinatrema, Epicrionops, Caudacaecilia* and *Ichthyophis.* The first two are confined to South America, the last two to Asia.

Rhinatrema has only a single known species, but this is well differentiated in having a transverse vent, and an exceedingly short tail which measures about 2 mm, and thus should not be confused with *Epicrionops* which has a longitudinal vent and a tail relatively much longer. The scales of *Rhinatrema* begin on the second collar, as is typical of most *Ichthyophis.* They soon form a complete row, but the number of scale rows does not increase in the folds more posteriorly. The anterior scales are small and transversely widened. Posteriorly they are gradually larger and tend to be more nearly circular. The individual squamulae are largely subequal in size and quadrangular in shape. The initium is close to the anterior edge of the scale.

The genus *Epicrionops* has several species that may be arranged in three groups that differ in color and markings:

I. Striped forms (3 species, 4 forms): *E. lativittatus, parkeri, bicolor bicolor* and *bicolor subcaudalis.*

II. Nearly unicolored caecilians (5 species, 6 forms): *E. unicolor, peruvianus, colombianus, niger, petersi petersi* and *petersi noblei.*

III. A single strongly marbled species: *E. marmoratus.*

Most of the species have the scales beginning on the collars or very near them and extending throughout the body. *E. peruvianus* is an exception, the anterior scales first appearing at or near the twentieth fold. (The condition in *colombianus* has not been reported and is not known to me.) The number of rows in a fold varies in different species from 1 to 4. Each of the three groups has one member with only a single row in each fold. As stated, the tails of *Epicrionops* species are longer than in other Gymnophiona. The number of folds on the tails vary from about 14 to 31 with an average number of about 24.

Caudacaecilia is represented by 5 species, distributed from the western Philippines to Sumatra and Thailand. The scales are distributed as follows: In *C. asplenia,* a striped form, scales begin at about the 30th fold and in-

crease to 5 rows in each fold posteriorly. In *larutensis*, lacking a stripe, scales begin at about the 80th fold and increase to 3 rows in each fold posteriorly. In the other three species the scales begin near the collars. In *nigroflava* there is a well-developed yellow stripe and the number of scale rows is 6 in the posterior folds. *C. paucidentula* is a very dimly striped species with 3 scale rows in the posterior folds. *C. weberi* lacks a stripe and there are 4 rows of scales in each fold.

The genus *Ichthyophis* as here treated contains some thirty species and is a rather unwieldly lot unless broken up into smaller groups based on characters other than scales.

I. Long tailed Indian species, all lacking a lateral stripe: *I. bombayensis, malabarensis, peninsularis,* and *subterrestris.*

II. Relatively short tailed species having a well-developed yellowish lateral stripe: *I. biangularis, elongatus, glutinosus, forcarti, atricollaris, hypocyaneus, pseudoangularis, paucisulcus, supachaii, kohtaoensis, tricolor,* and *beddomei.*

III. Species nearly unicolor without stripe: *I. laosensis, taprobanicaensis, orthoplicatus, billitonensis, acuminatus, monochrous, sikkimensis, singaporensis, glandulosus, dulitensis, youngorum, javanicus, sumatranus,* and *mindanaoensis.*

The first group of Indian species has the scales distributed as follows: In *malabarensis* scales begin on the collars or the first fold following the collars and increase to 9 or 10 rows posteriorly. In *bombayensis* scales begin at or near the 7th fold and increase to 3 rows posteriorly. In *peninsularis* scales begin on the neck near the collars and increase to 5 scale rows in a fold posteriorly. This is also the case in *subterrestris.*

In the second group, nine species have the scales beginning on the collars, three at some distance back of the collars.

In the third group (lacking stripes), seven have scales beginning on the collars and seven have the scales beginning at some distance posterior to the collars.

When arranged according to the numbers of scale rows in a single fold, the members of the second and third groups are as follows:

Maximum of one row posteriorly: *youngorum.*

Two to 5 rows in each posterior fold: *acuminatus, atricollaris, billitonensis, hypocyaneus, laosensis, sikkimensis, biangularis, glandulosus, kohtaoensis, mindanaoensis, sumatranus, supachaii, orthoplicatus, monochrous, dulitensis, forcarti, javanicus,* and *paucisulcus.*

Seven to 10 rows of scales in each posterior fold: *singaporensis, taprobanicaensis, elongatus, glutinosus, pseudangularis, tricolor,* and *beddomei.*

Family **Caeciliidae**

Subfamily **Caeciliinae**

The two genera *Caecilia* and *Oscaecilia* which compose this subfamily occupy for the most part territory in Central America and in northern and western South America. Only a few species are known in the great expanse of Brasil. The seeming absence of the Caeciliinae over large parts of South America may be due merely to the absence of collections or to their absence where collections have been made, or to the failure of herpetological collectors to make the necessary and sometimes arduous efforts to obtain them.

This group seems also to display extraordinary diversity with regard to squamation. Scales may be present or they may be totally absent, depending on the species. If present there is diversity in the disposition of the scales themselves. They may extend from near the collars to the terminus of the body. None may precede the point where the secondary folds first appear, or they may extend far in advance of the secondaries. Sometimes there are no secondaries present and there may or may not be scales in the primary folds.

At the most anterior point where scales are found, there are but few scales in a fold. These may be dorsal, or they may form short rows only on each side. If the folds are complete dorsally and ventrally the scales begin to form one or more rows around the body and this may continue posteriorly to the terminus. This is similar to conditions in the family Ichthyophiidae. In some species of the Caeciliinae the scale rows may be confined to the posterior part of the body—sometimes to the last half dozen folds—and in one species the scales may be normal for the genus, in another they may be much specialized.

The individual scales may vary considerably on various parts of the body. Anteriorly they are much smaller and the greatest dimension of the scale is usually, if not invariably, transverse. Posteriorly the scales tend to increase gradually in size such that the largest body scales are usually, if not invariably, to be found in the last three centimeters of the body length. This does not mean that all the scales in the row will have the same large measurement, since if more than a single row is present the scales of one whole row may be larger than another row below or behind it. Even when only a single row is present a few scattered small scales may also be present. Where possible I have endeavored to illustrate the larger scales from the last centimeters of the body, usually the one immediately preceding the vent. (There is no tail.) If there is but a single row, the scales may be nearly of the same size, each in a separate pocket closely overlapping; those from the right overlap to the left, those from the left overlap the scales on the right with usually a single median dorsal scale. It is often possible to tell, by an

examination of a detached scale, on which side of the body it developed, since the scales from the sides are less symmetrical than those near the median parts of the fold.

Many species in this subfamily also have other scales which I have designated subdermals. I have not attempted to ascertain the distribution of the subdermals since to get accurate data one would necessarily destroy much of the surface of the animal. These scales are placed away from the folds, in the connective tissues that fasten the skin to the body. They are usually very small, nearly circular and they may appear at different depths in the tissues. Sometimes they may be scattered. Occasionally they are so numerous in places as to occupy nearly all available surface. These subdermal scales have also been found in a few species I regard as members of the Dermophiinae, the other subfamily of the Caeciliidae.

The typical scales of the primary and secondary folds of the Caeciliinae are larger in proportion to body size than elsewhere in the order. Unfortunately it has not been possible to show comparative size in the illustrations since some of the scales presented may have a size 40-50 times greater than the smallest. In consequence, actual measurements of at least one scale in each figure is given while the others in the same figure are proportionally enlarged unless it is so stated. The largest known species of the Order occur in this subfamily but even in the smaller species of the two genera the scales are larger on the whole than in similar-sized species in other families.

The subfamily of 27 recognized forms divides itself into several groups as regards scale characters. Four species of *Caecilia (dunni, perdita, antioquiensis,* and *gracilis)* have more than a single scale row in the folds where scales are present. Of these, all except *gracilis* have the subdermal scales in addition to the others. A few forms presumably lack all trace of the scales in the folds. These are *attenuata, caribea, corpulenta,* and *pachynema,* and of these only *pachynema* is known to have subdermal scales. Two species have specialized scales that are rigid or "bony." These are *armata* (*fide* Dunn) which is said to have "the hind half of the body with bony scales," and *crassisquama* which has only a few in the near terminal folds. Neither is known to have subdermal scales (*armata* not examined by me).

The greater number of species of *Caecilia* are characterized by having a single overlapping scale row in each fold, complete or incomplete depending upon whether the folds themselves are complete. This series of species includes *albiventris, abitaguae, bokermanni, disossea, flavopunctata, guntheri, leucocephala, nigricans, occidentalis, orientalis, pressula, subdermalis, subnigricans, subterminalis, tentaculata, thompsoni,* and *volcani.* Of these *abitaguae, bokermanni, guntheri, orientalis, pressula, subnigricans,* and *tentaculata* are not known to have subdermals.

It is difficult to account for the presence or absence of the subdermal scales. In certain cases where subdermals are not known it is possible the species has not been examined carefully or the minute scales may have been overlooked.

Subfamily **Dermophiinae**

This subfamily is especially diverse in the characters of the squamation. None of the recognized generic groups have lost the scales completely nor have species been found in which some members of a population may appear without scales as sometimes occurs in the Caeciliinae.

The scales of *Dermophis* are medium to large in size, the squamulae on the scale surface also differing somewhat in their size and distinctness. There is a general tendency for the scales to be subcircular posteriorly on the body although scales in more anterior parts may have their transverse dimension the greatest. The initium of the scale is usually near the scale center so that in a detached scale it is difficult to distinguish the anterior from the posterior section. *Dermophis parviceps* is an exception with the initium closer to the anterior border.

Of the recognized species, *D. balboai* has the greatest number of scale rows in the posterior folds (8), while two or three species may have as few as 3 rows. The scales appear first at about the 30th fold (from head). *D. oaxacae* ranks next with at least 6 scale rows in the posterior folds, but in this form scales begin near the collars so there will probably be a larger total of scale rows. *D. mexicanus mexicanus* likewise has the scales beginning at the collars, but the number of scale rows in a fold does not exceed 3, even posteriorly.

In *Dermophis costaricensis, eburatus, glandulosus,* and *gracilior* the scales begin at some point between the 12th and 18th fold with 3-5 rows in a fold posteriorly, while in *occidentalis* and *parviceps* the scales usually begin near the 50th fold, not far from the middle of the body.

Cryptopsophis simus has scales somewhat resembling those of the larger *Dermophis* but they are not subcircular, having their transverse diameter greatest.

The genus *Gymnopis,* represented by three forms, has medium large scales. *G. multiplicata proxima, G. m. oligozona,* and *G. m. multiplicata* have scales differing considerably in shape and in the position of the initium and in the size of the individual squamulae on the scales. The distribution and numbers of rows are similar in the three forms.

Microcaecilia has four recognized forms, and they differ greatly in the distribution of the scales. In *M. albiceps* they begin at the 11th fold, increasing to 6 rows of scales in each fold. In *M. unicolor* scales begin at the 20th fold and in *M. rabei* at about the 86th fold, the number in each fold

increasing to 4-5 posteriorly in each species. On the other hand, *M. supernumeraria* has scales beginning in the first primary fold, increasing to 5-6 posteriorly in the posterior half of the body. The scale rows are exposed beyond the edge of the fold as is shown in Figure 100. This is a very unusual condition in Caecilian squamation.

In *Parvicaecilia* only two forms are recognized. In both *P. nicefori* and *P. pricei* the scales begin between the 21st and 29th folds and increase to 4 rows in the posterior folds in both species.

The scales of *Idiocranium russeli*, an African form, are seemingly similar to those of *Parvicaecilia pricei* and *Microcaecilia albiceps*, two South American forms. The character of the skull of the African species, however, sets it apart from all other Caecilian genera.

In the genus *Schistometopum*, with four recognized forms, I have samples of only two, *thomense* and *ephele*. While the scales of these presumed forms show marked difference in the distinctness of the individual squamulae, Mr. Cutler, who made the figures of the scales of *ephele*, had difficulty in getting them, saying that the scales were "too thin to bring out the contrast."

The Asiatic genus *Uraeotyphlus* has four recognized forms. The scales appear to show what might be regarded as generic similarity in the appearance and distribution of the squamulae on the scales. The distribution of scales on the body begins near the same point (11th to 16th fold in three forms), the scales forming 4-7 rows posteriorly in each fold. In *U. malabaricus* the scales begin farther back near the middle of the body and increase to 4 rows posteriorly.

In the African genus *Geotrypetes*, with four recognized species, the scales are medium large, the individual squamulae relatively large and equal-sized throughout the scale surface. The initium is usually near the center of the scale. Specific differences in scale appearance are not easily discerned. The scales usually begin between the 15th and 45th fold. In three species there are 4 scale rows in the posterior folds and in three others 7-9 rows in each fold.

In the Asiatic genus *Gegeneophis* three species are recognized, one of which may doubtfully be associated. This is *Gegeneophis fulleri*, known from the single type specimen now in Calcutta, India, from Kuttal, Cachar, Assam. This specimen has not been studied satisfactorily nor have the scale characters been noted in detail. Scales are present in the last third of the body beginning about the 70th fold, and the folds posteriorly have only 1 row of scales. In *G. ramaswamii* the scales begin at about the 8th fold and increase to 4 rows in each fold posteriorly. *G. fulleri* has a much widened terminus of the body, as does *G. ramaswamii*, a character seem-

ingly confined to this genus. In *G. carnosus* the widening is scarcely evident.

In *Indotyphlus* the small scales are seemingly confined to the last one fourth or one fifth of the body. They increase to 3 scale rows in the posterior folds.

The caecilian fauna of the Seychelles, a small group of islands in the Indian Ocean, embraces a remarkable diversity consisting of at least 3 recognized genera and about 10 forms placed in 7 species. The genus *Praslinia* is especially remarkable in having nearly double the number of teeth found in any other species of the Gymnophiona.

Hypogeophis is another genus having but 1 recognized species but it is represented by subspecies on various islands. In this genus scales in *H. rostratus rostratus* begin about the 60th primary fold and increase to 2 scale rows in each fold posteriorly. In *H. r. guentheri* and *H. r. praslini* the scales appear first about the 25th primary fold and increase to 2 or 3 posteriorly. In *H. r. lionetti* scales appear at the 20th fold and increase to 4 or 5 rows in each posterior fold.

Grandisonia consists of two groups of species. One of these is composed of two species, *brevis* and *diminutiva,* two of the smallest species of the order and having the lowest number of vertebrae. The second group consists of three larger forms, *larvata, sechellensis* and *alternatus.* In this second group the scales begin near the collars in *alternatus,* increasing to 6-7 scale rows in the posterior folds, but in *sechellensis* scales begin about the 23rd fold, increasing to 3 scale rows in the posterior folds. Data on *larvata* are not now available.

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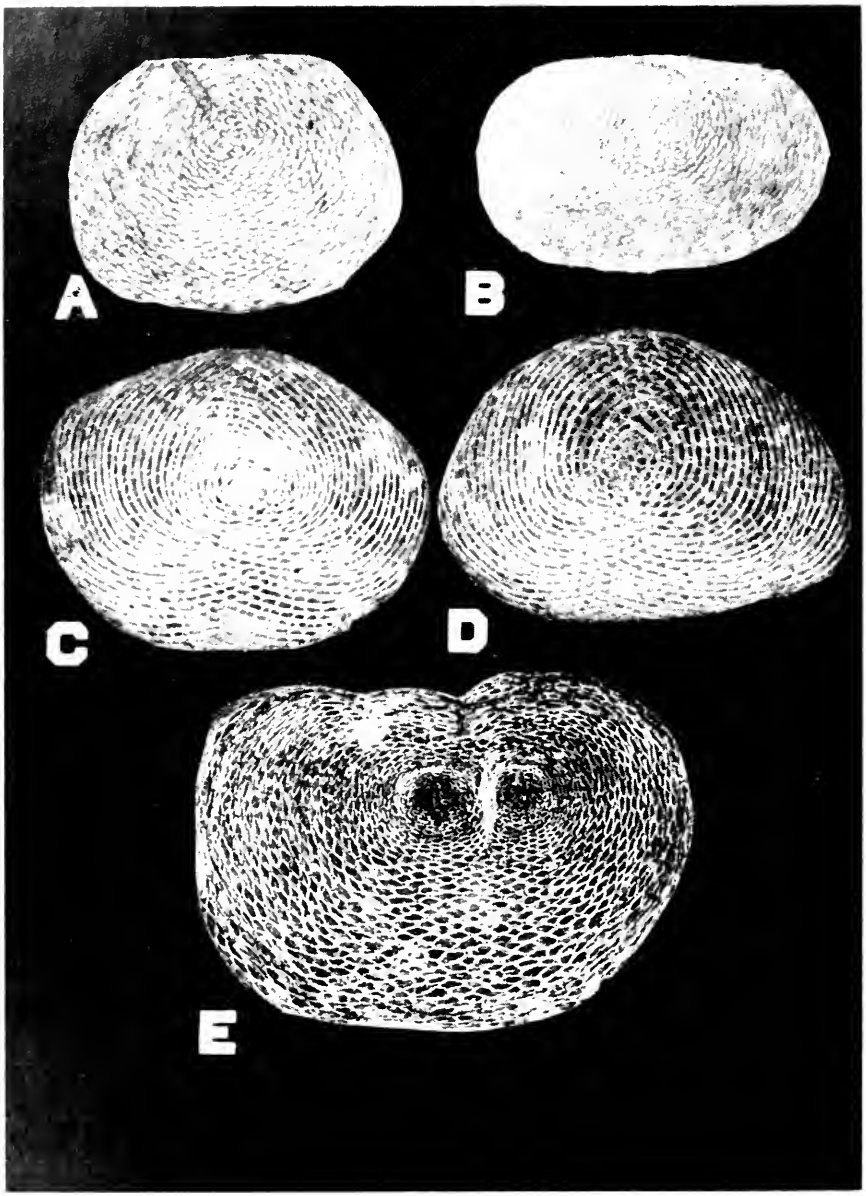

FIG. 1. Contrast of pictures of caecilian scales made with a camera, "positives," and without a camera, "negatives." In A and B the squamulae appear to be white or light-colored (positives by camera). In C, D, and E, "negatives" without a camera, they are dark. A-B) *Geotrypetes grandisonae*, Type, Ethiopia. C-D) *Ichthyophis supachai*, Na Pradu, Yala, Thailand. E) *Caecilia* sp., Moruna Santiago, Ecuador.

FIG. 2. *Ichthyophis atricollaris* Taylor. Squamulae at upper right form part of the initium, around which quadrangular squamulae are arranged in curving rows. About 900×.

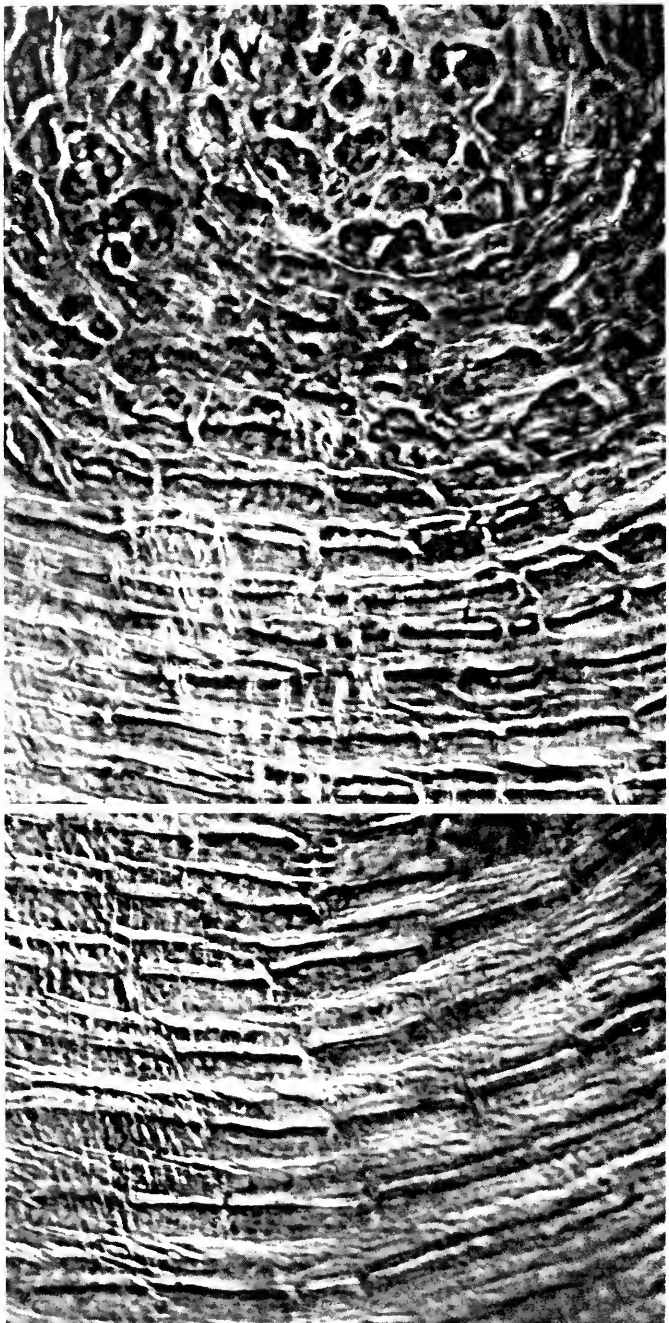

FIG. 3. *Ichthyophis laosensis* Taylor. Type, MNHN no. 1928.95, from "Haut Laos." Upper figure, an area near the initium with surrounding squamulae. Lower figure shows squamulae of the same scale near its periphery. About 800×.

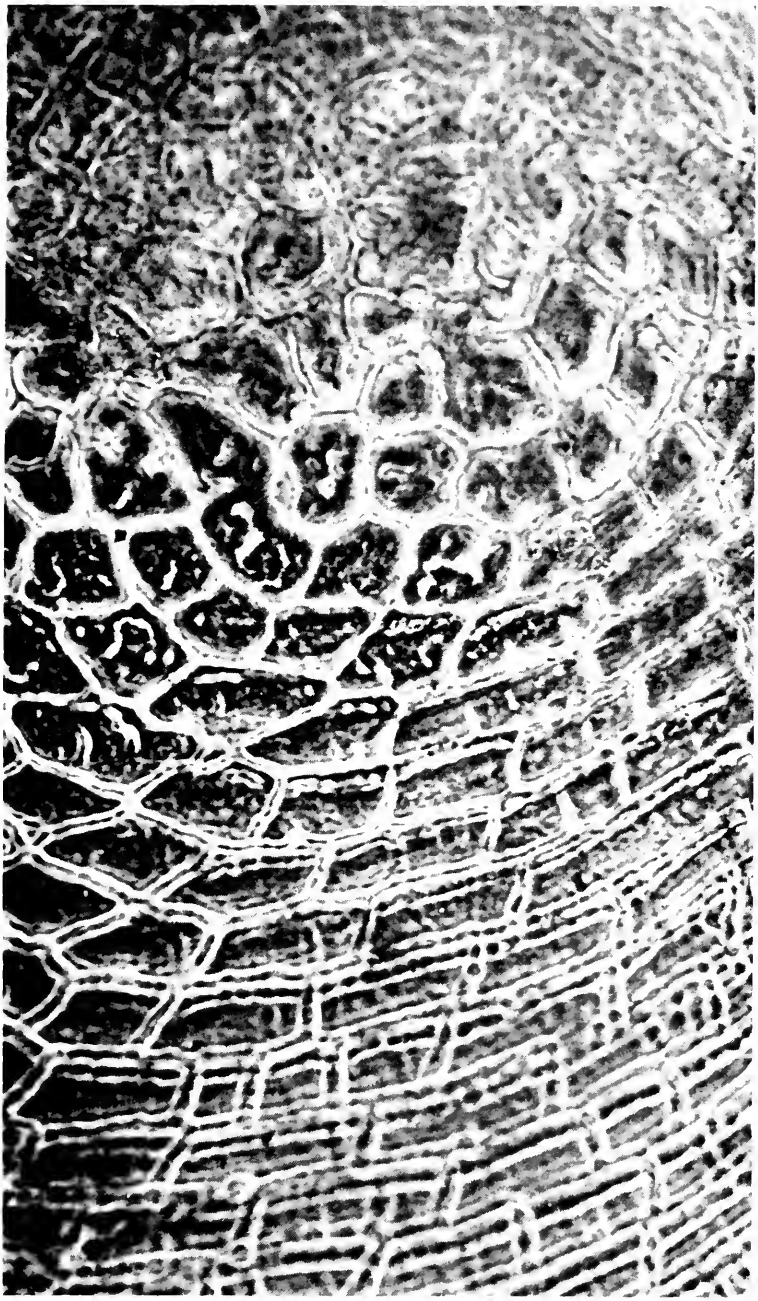

Fig. 4. *Ichthyophis tricolor* Annandale, ZSIC no. 17667, Perambakulam, Cochin, India, 1700-3200 ft. elev. The upper part shows much of the intium with the more regular squamulae surrounding it. These continue to the posterior periphery of the scale. About 850×.

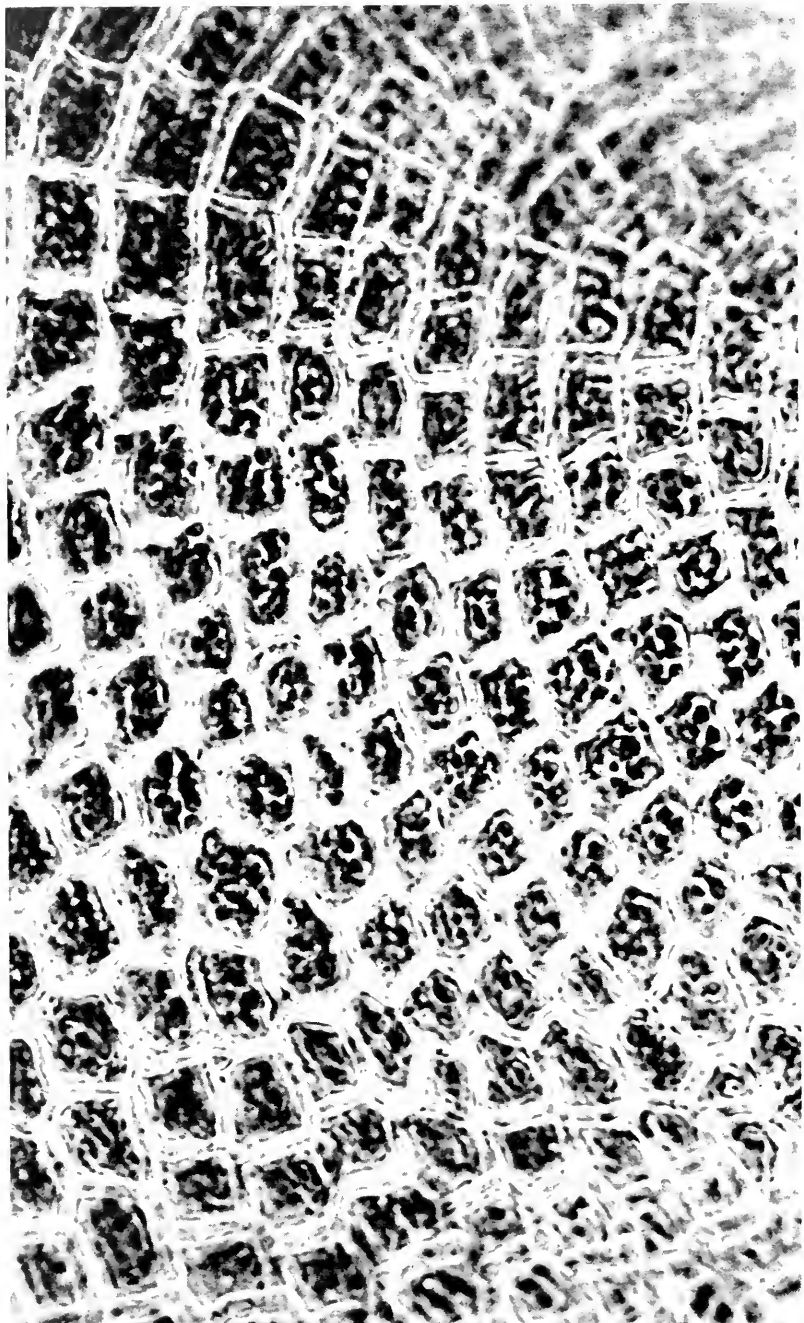

FIG. 5. *Rhinatrema bivittatum* Cuvier. Scale from type. (French Guiana, MNHN no. 585.) Curved rows of quadrangular squamulae posterior to the imituum (which is at the right). About 900×.

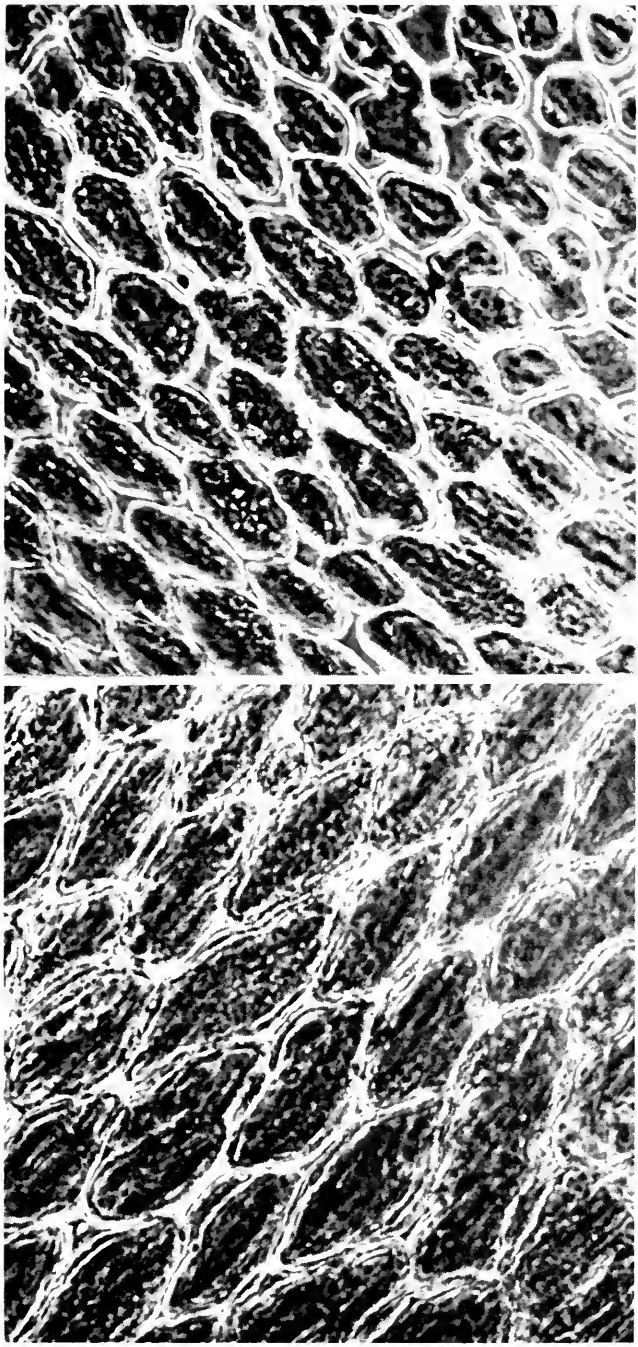

FIG. 6. *Oscaecilia polyzona* (Fischer). Cotype, ZMB no. 9524, Antioquia, Colombia. Upper figure, rows of squamulae bordering the initium (at upper right); lower figure, squamulae along the posterior periphery of the scale. About 800×.

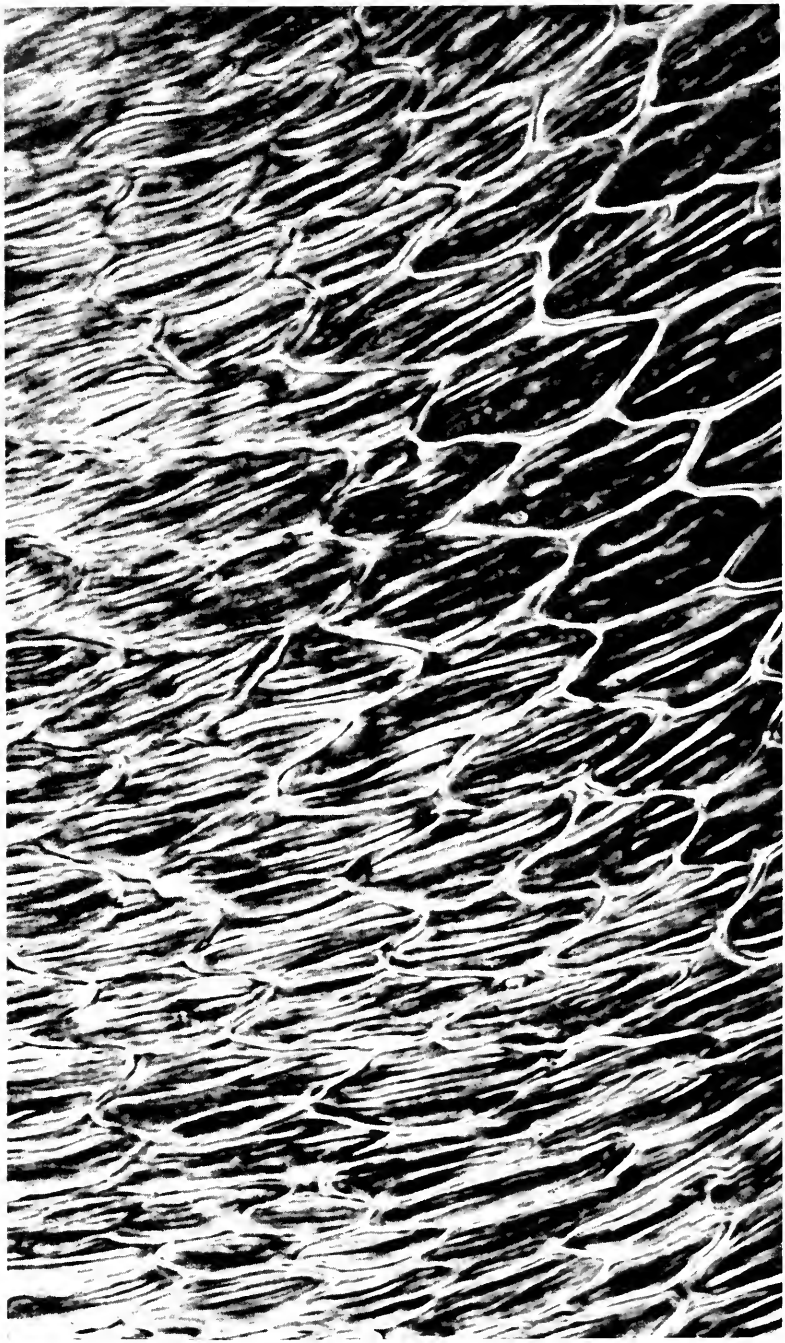

FIG. 7. *Caecilia pressula* Taylor. Scale from type, AMNH no. 19475, Maruch Mts., Guyana. Squamulae from the posterior part of the scale. About 925×.

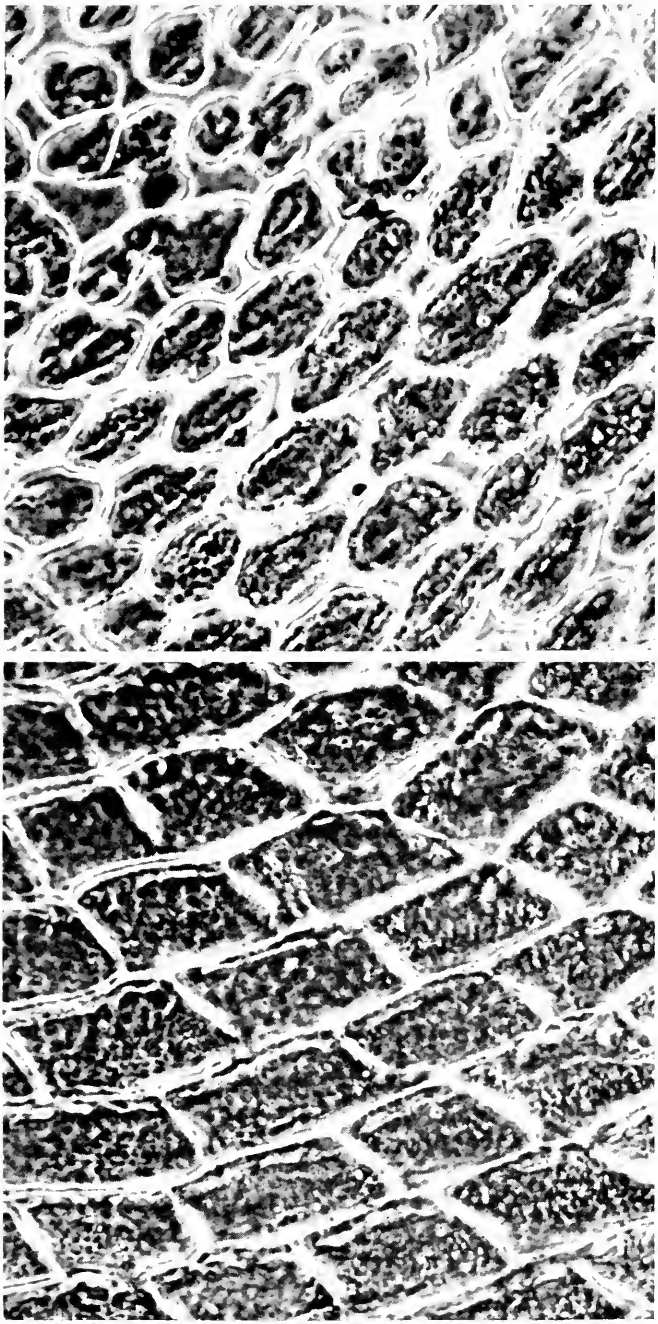

FIG. 8. *Geotrypetes pseudoangeli* Taylor. Scale from paratype, MNHN no. 20-190, from Beyla, French Guinea, Africa. Upper figure, the edge of the imbum (top) with rows of somewhat irregular squamulae bordering. Lower figure shows large, rather regular rows of squamulae continuing to near the periphery posteriorly on the scale. About 850×.

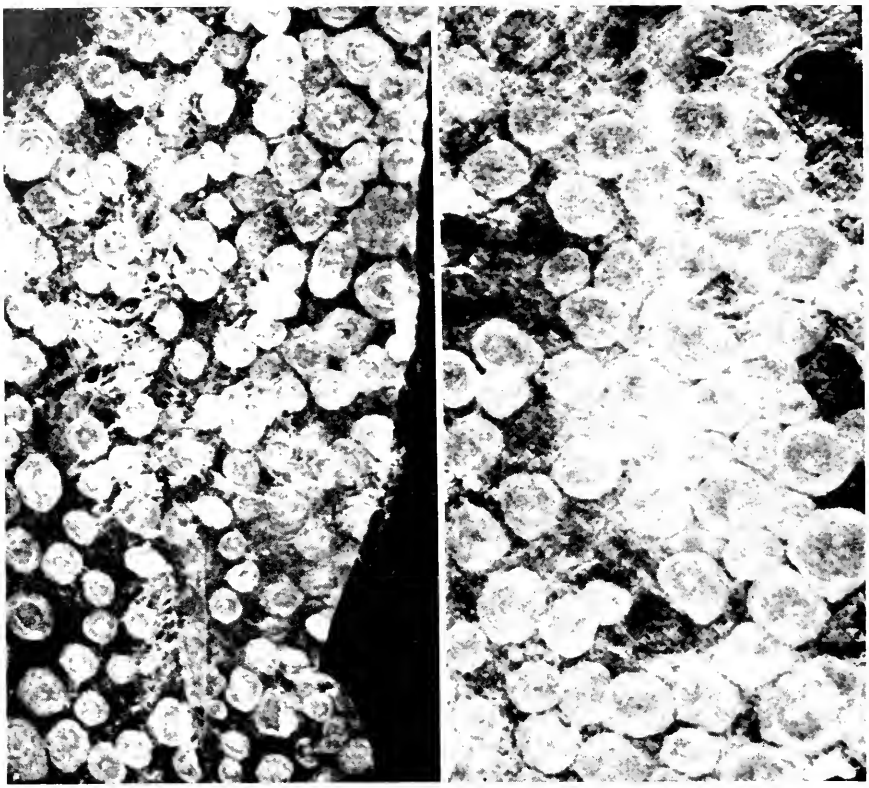

FIG. 9. Subdermal scales in connective tissue. Left, *Caecilia albiventris;* right *Caecilia nigricans*. All scales less than 0.6 mm.

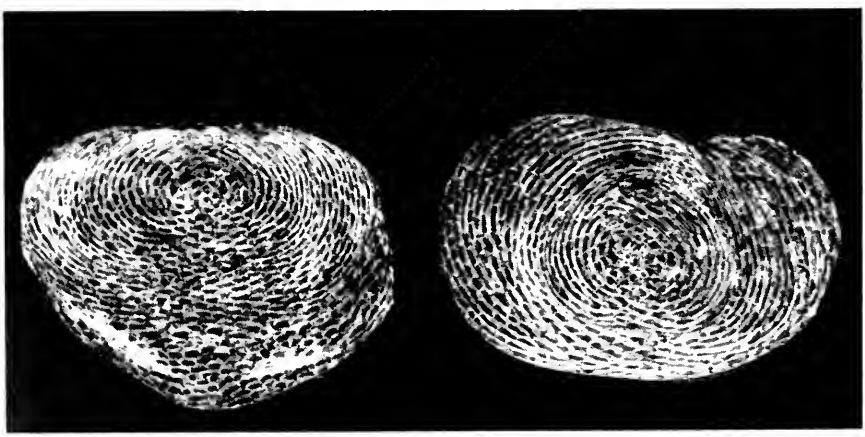

FIG. 10. *Ichthyophis acuminatus* Taylor. Scale from type, AMNH no. 20875, Me Wang Valley, Northern Thailand. These measure 1.3 × 1.15 and 1.4 × 1.0 mm.

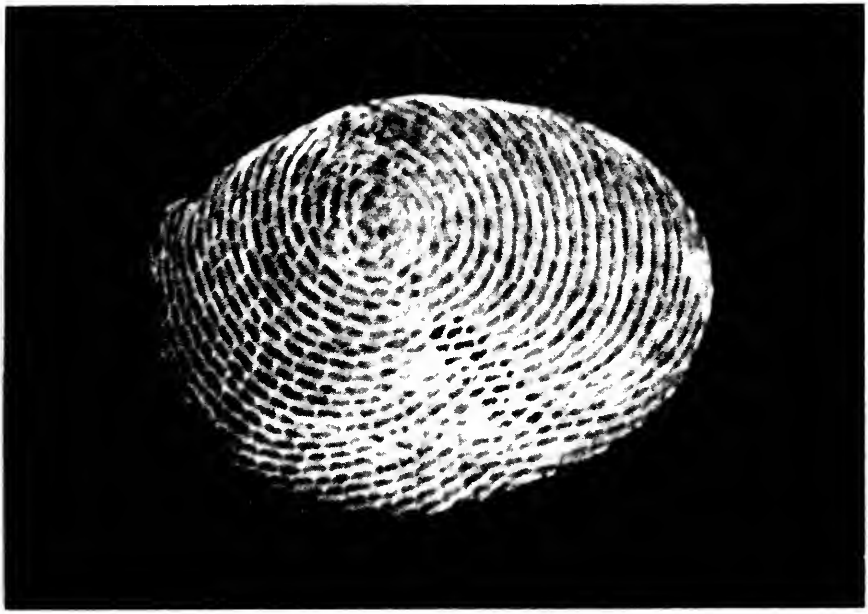

FIG. 11. *Ichthyophis atricollaris* Taylor. Scale from type, RNHL no. 16084, Long Bloet, boven Mahakkam (river), Borneo. This measures about 0.7 × 0.98 mm.

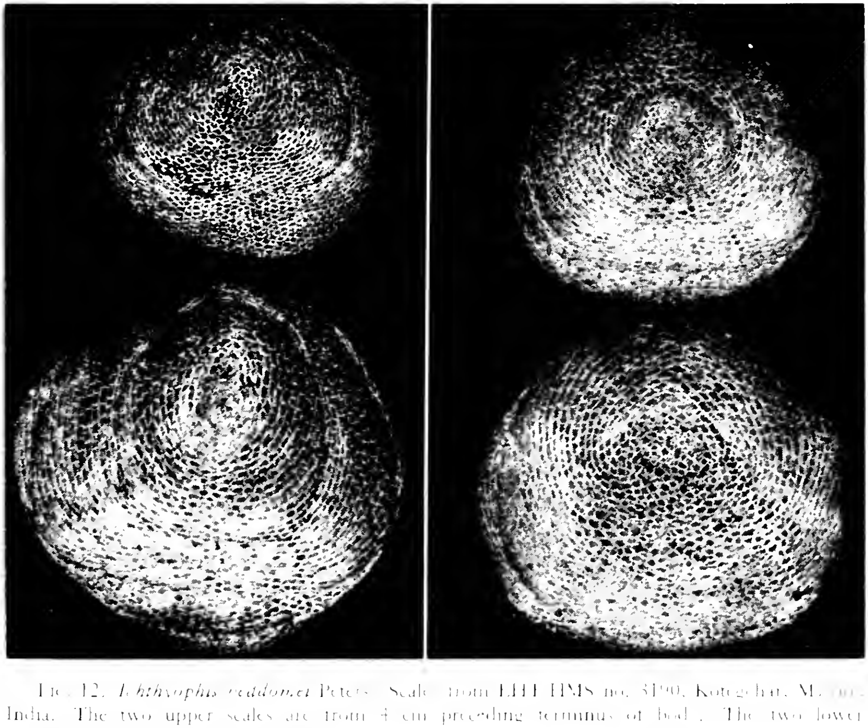

FIG. 12. *Ichthyophis beddomei* Peters. Scale from EHT-HMS no. 3190, Kotegehar, Mysore, India. The two upper scales are from 4 cm preceding terminus of body. The two lower measure 1.2 × 1.4, 1.1 × 1.25 mm.

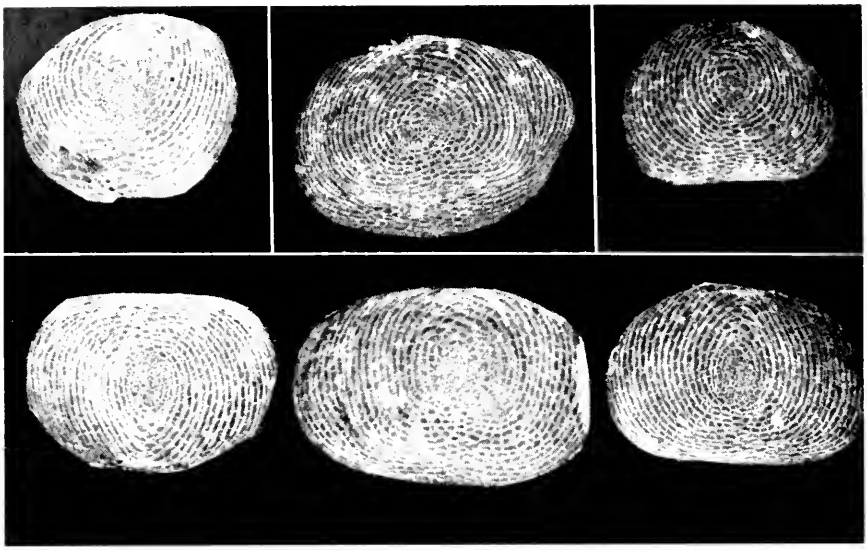

FIG. 13. *Ichthyophis biangularis* Taylor. Scales from BMNH no. 1947.1.1.69, Kambakkam Forest, Eastern Ghats, India. The largest scale (middle lower) measures 1.0 × 1.69 mm.

FIG. 14. *Ichthyophis billitonensis* Taylor. From the type, ZMA no. 5209, Billiton Island (between Sumatra and Borneo). The two scales illustrated measure 0.95 × 1.2 and 0.8 × 1.06 mm.

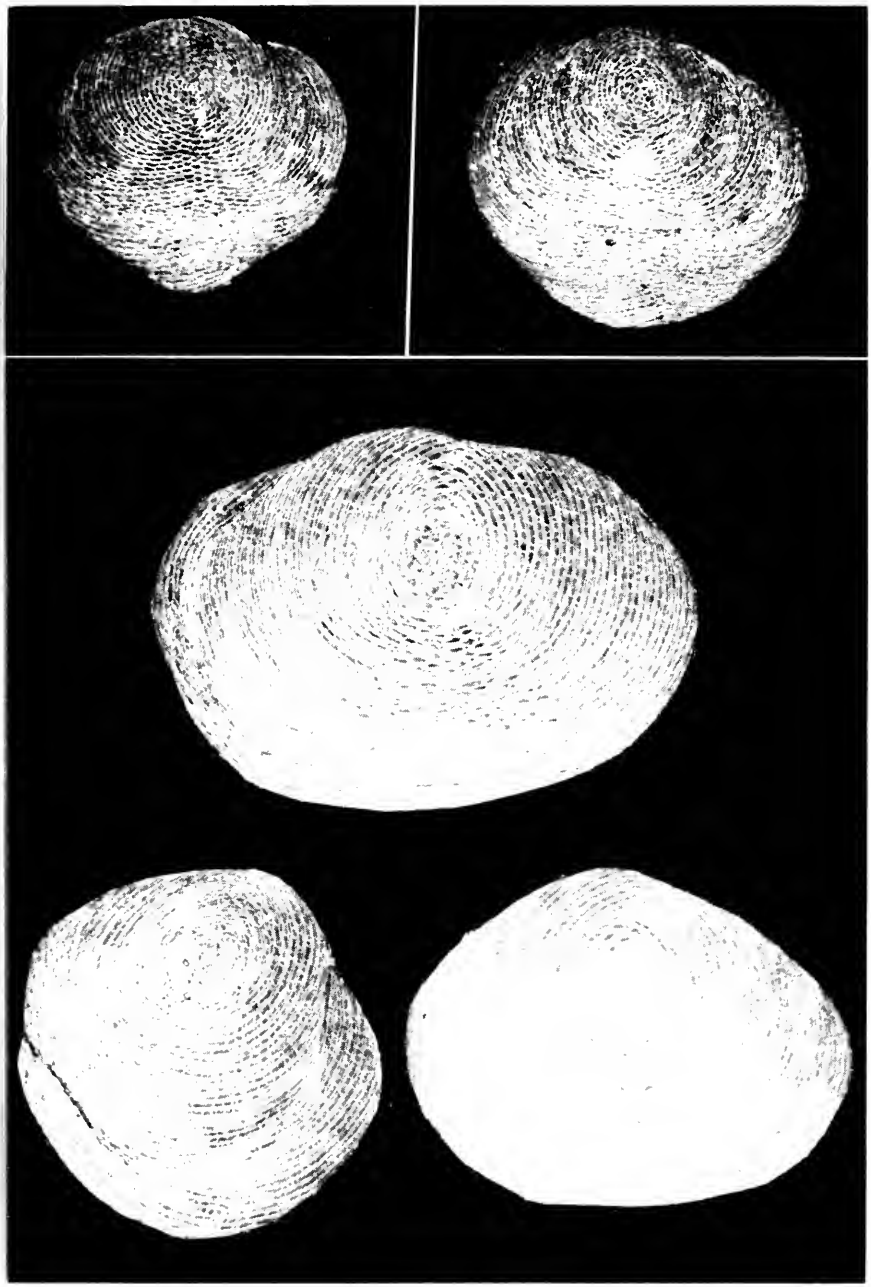

FIG. 15. *Ichthyophis dulitensis* Taylor. Scales from type, EMNH no. 92.6.3.23, Mt. Dulit above 2000 ft., Sarawak, Borneo. The largest scale (middle figure) measures about 1.3 × 1.9 mm. The two upper scales are from a point 5 cm from the end of body.

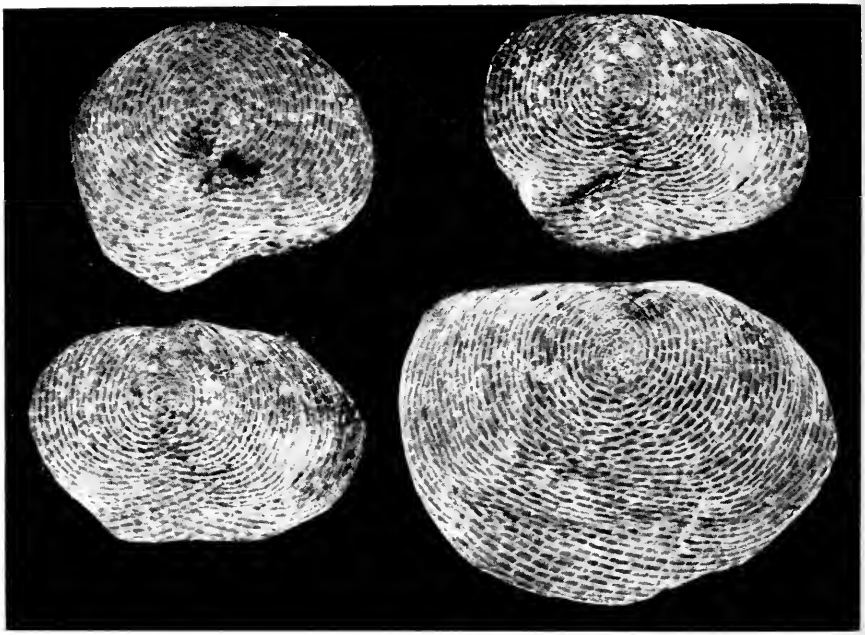

FIG. 16. *Ichthyophis elongatus* Taylor. Scales from type, NMW no. 9094, Padang, Sumatra. Largest scale about 1.15 × 1.8 mm.

FIG. 17. *Ichthyophis forcarti* Taylor. Scales from type, MHNB no. 4411, Ceylon.

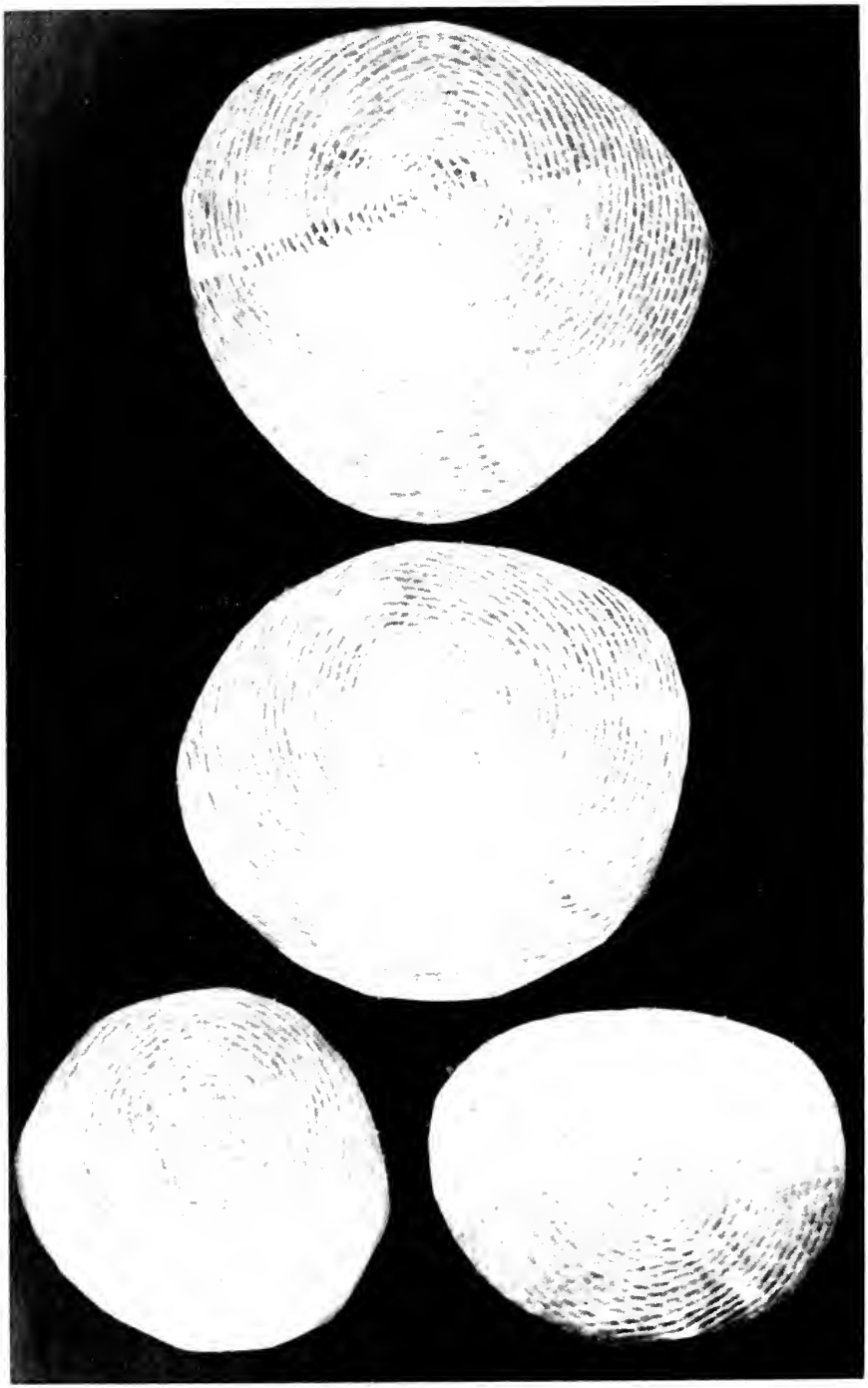

FIG. 18. *Ichthyophis glutinosus* (Linnaeus). Scales from AMNH no. 20868, Ceylon. Middle scale about 1.6 × 1.8 mm.

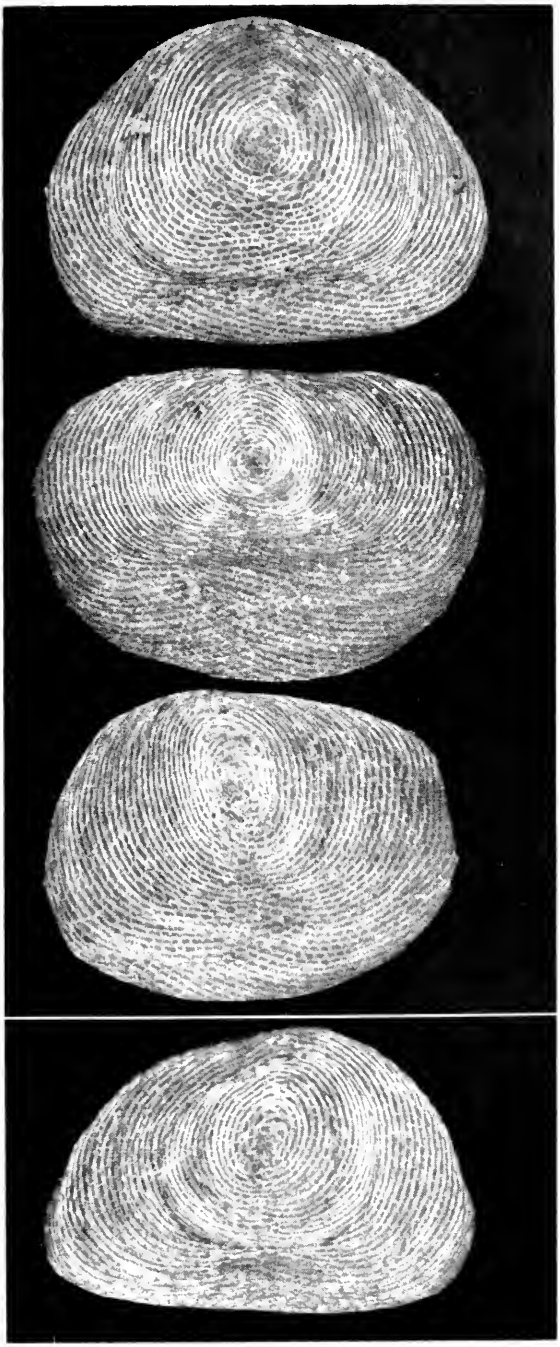

FIG. 19. *Ichthyophis hypocyaneus* (van Hasselt). All scales from MNHN no. 39-207, from Batavia, Java.

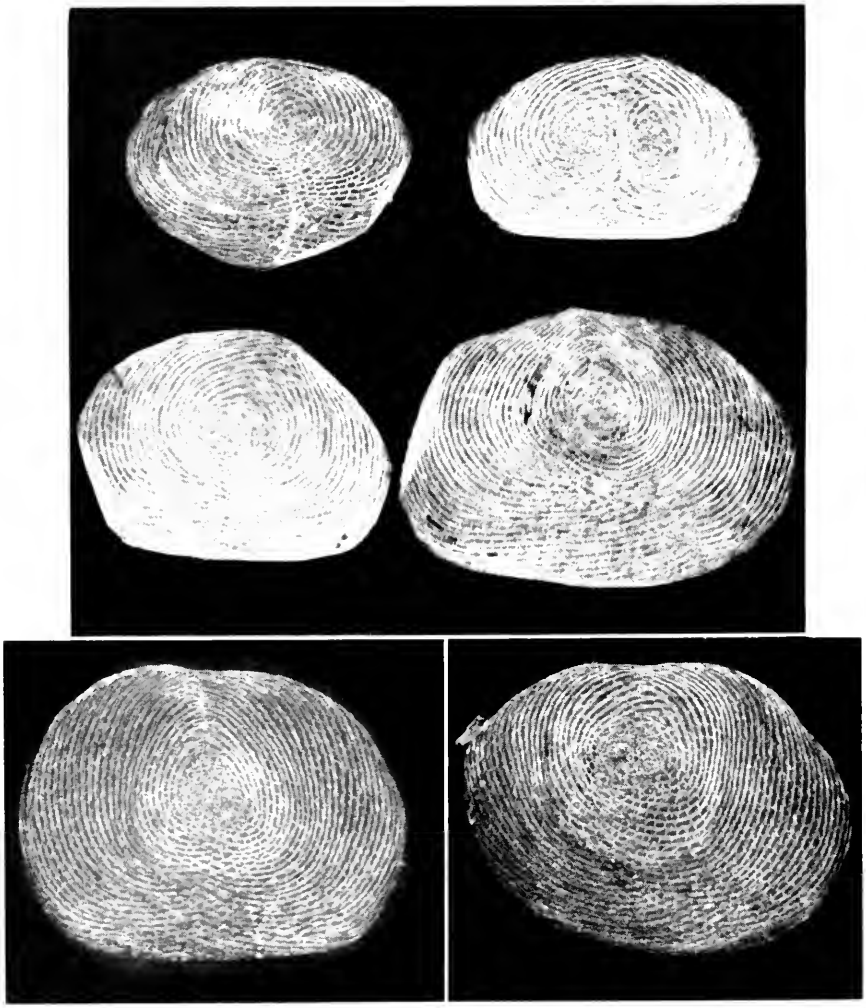

FIG. 20. *Ichthyophis hypocyaneus* (van Hasselt). Four upper scales from type, RNHL no. 2408, Java; the three smallest, 5 cm preceding vent. Two lower scales, MNHN no. 39·207.

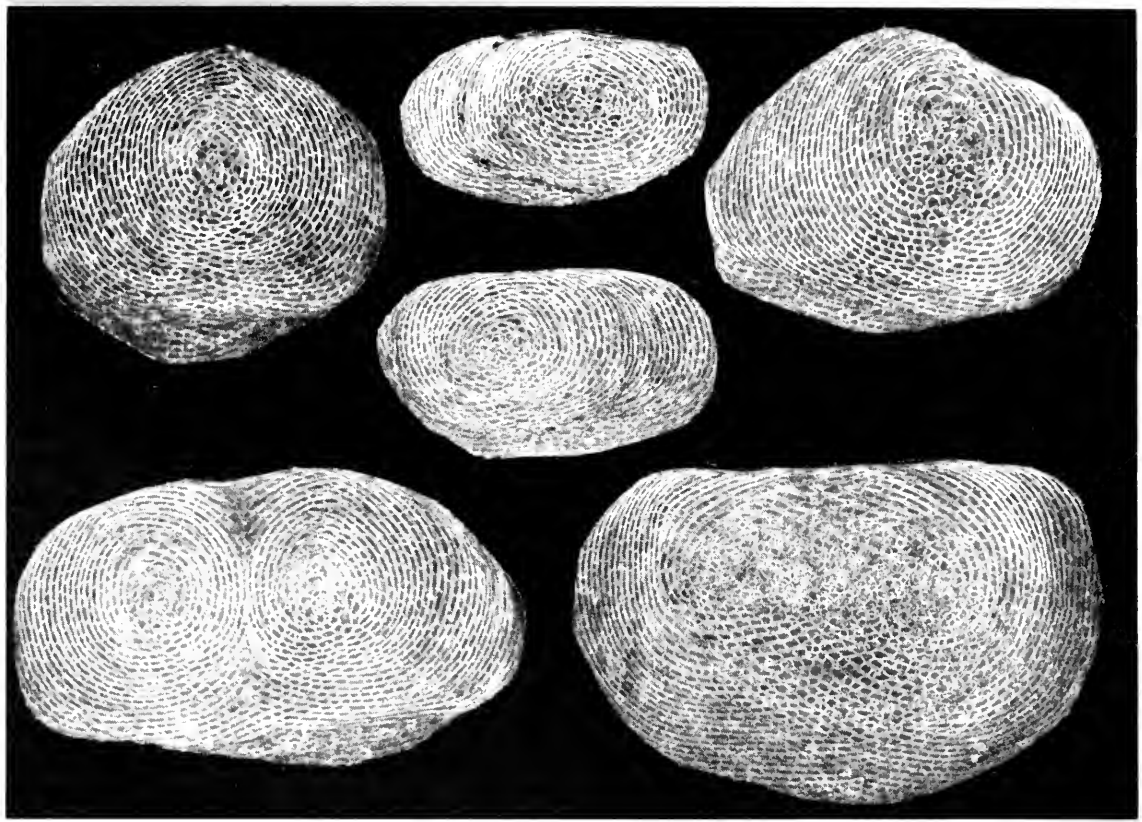

FIG. 21. *Ichthyophis javanicus* Taylor. Scales from MNHN no. 39*206, "Batavia, Java." Two lowest scales, each abnormal "twins"; smallest scales from fifth cm preceding vent.

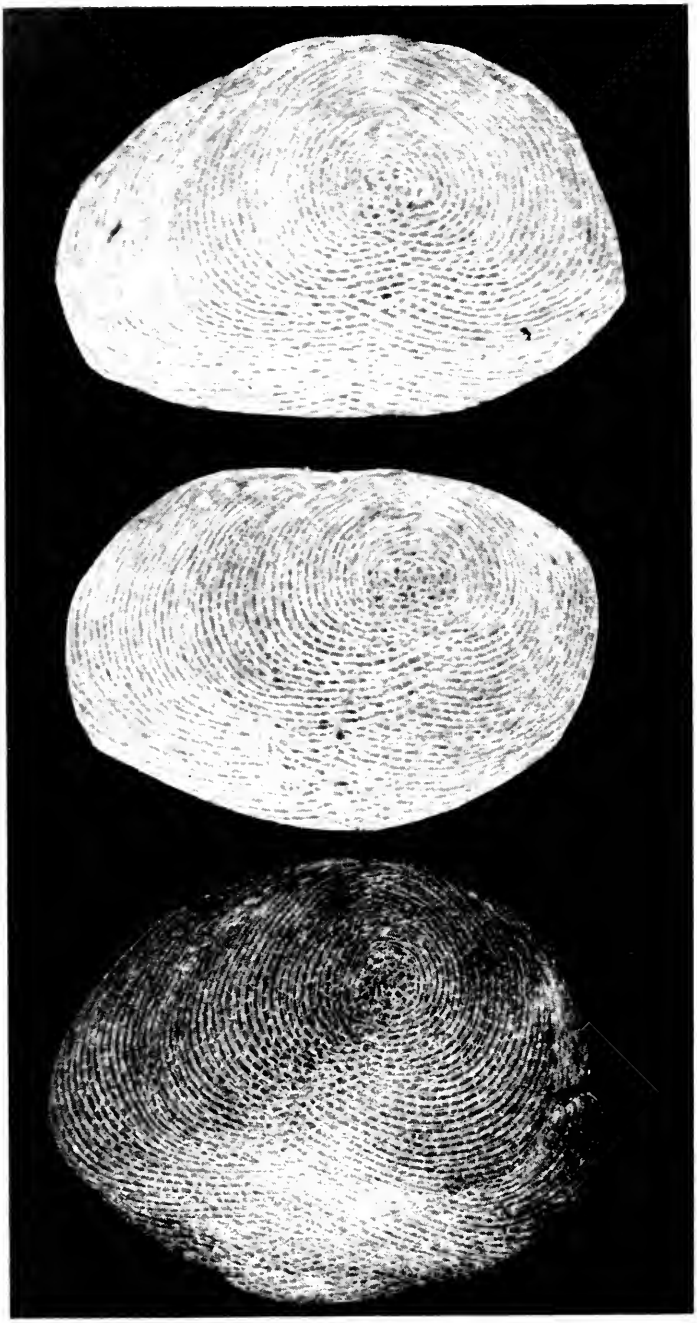

FIG. 22. *Ichthyophis kohtaoensis* Taylor. Two upper scales from USNM no. 10162, Chiang Mai, Thailand. Lower scale from EHT-HMS no. 3933, Chiang Dow, Chiang Mai, Thailand. Lower (largest) measures 2.1 × 2.7 mm.

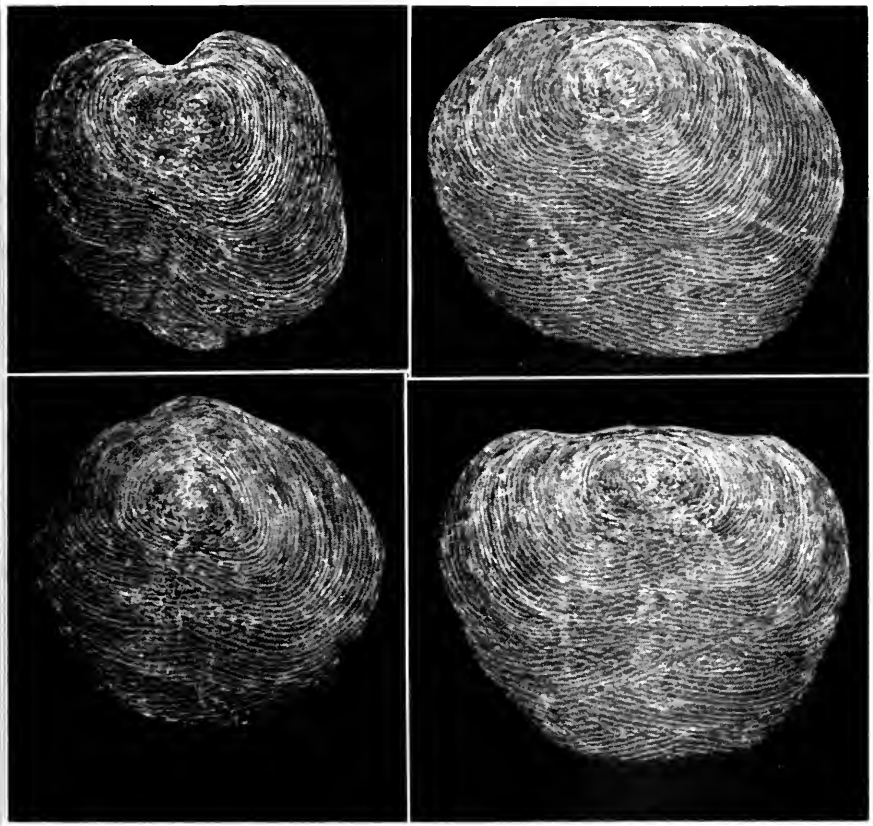

Fig. 23. *Ichthyophis laosensis* Taylor. Scales from type, MNHN no. 1928*05, from "haut Laos." The largest scale measures 1.5 × 2.0 mm.

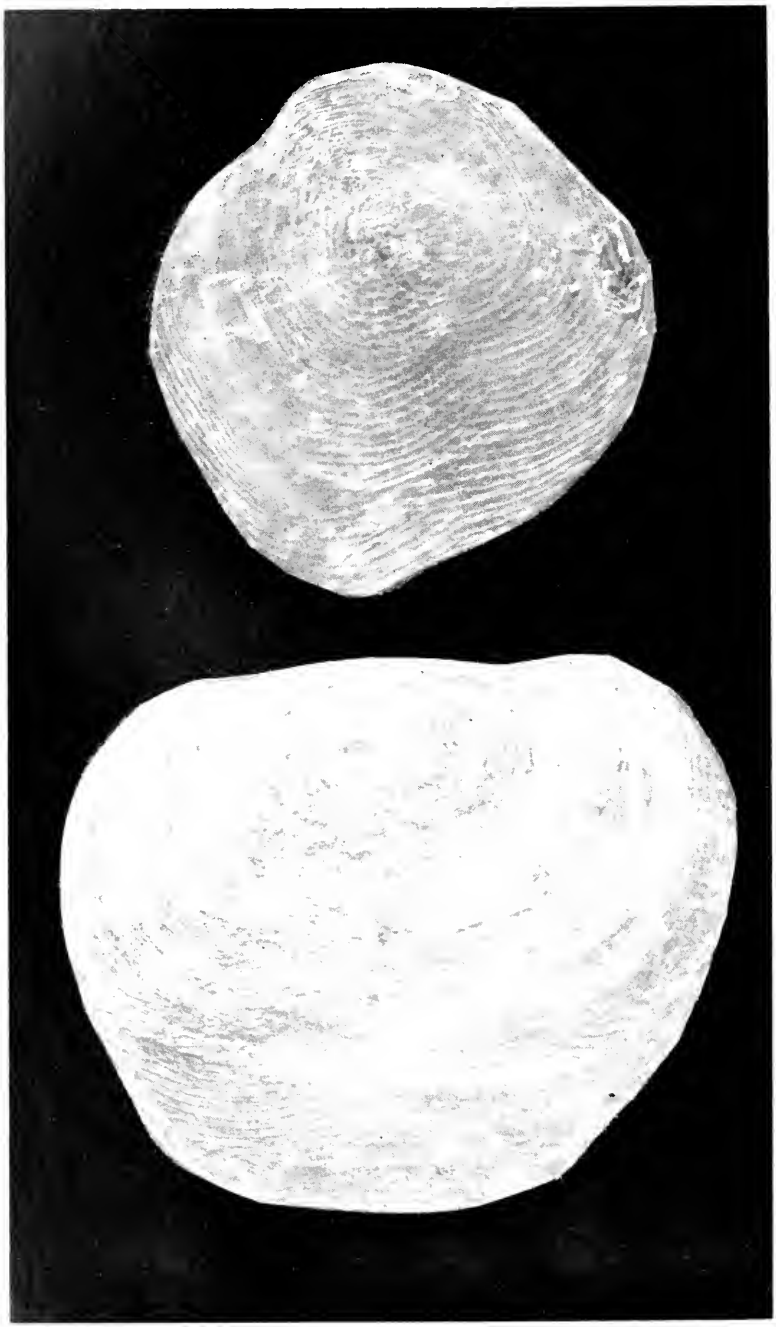

FIG. 24. *Ichthyophis laosensis* Taylor. Scales from type, MNHN no. 1928.95, "haut Laos." The individual squamulae are difficult to discern.

FIG. 25. *Ichthyophis malabarensis* Taylor. Scales from Bangalore Univ. no. 3, without locality. Largest scale (notched abnormally), 2.2 × 2.8 mm.

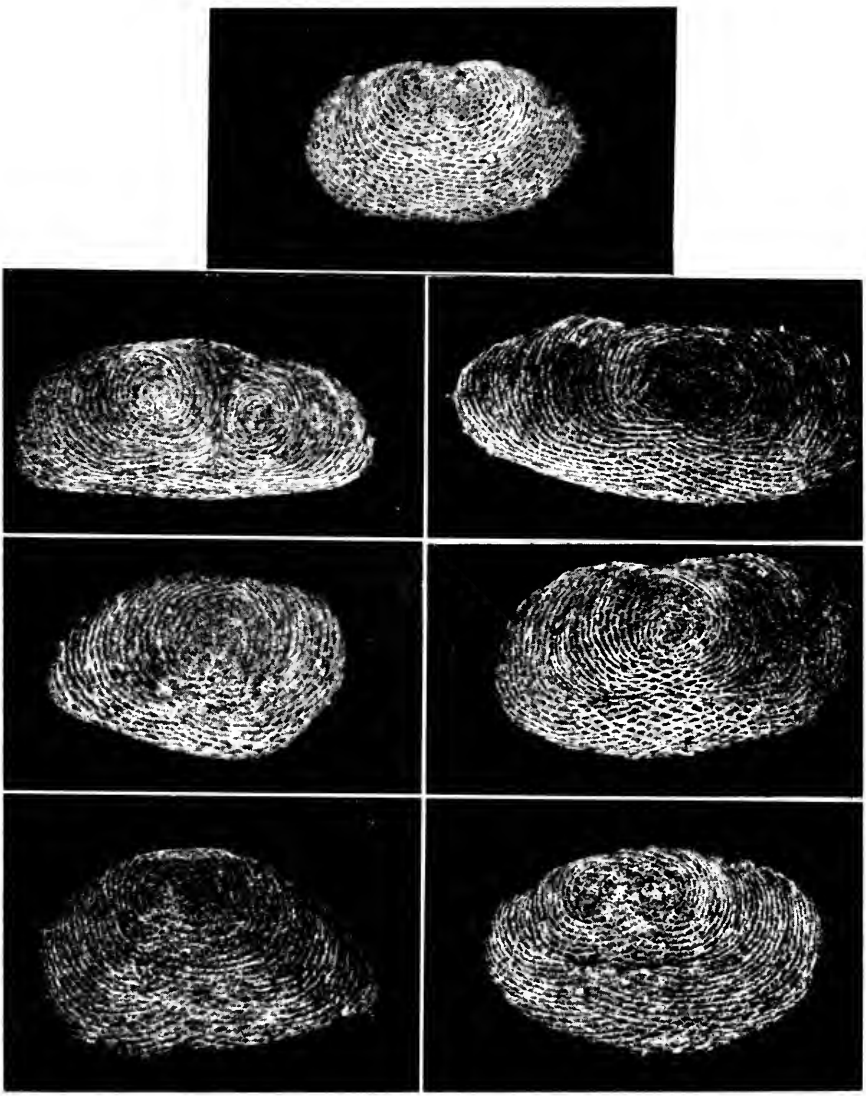

FIG. 26. *Ichthyophis mindanaoensis* Taylor. Three upper scales from C.A.S. no. 20925, from Mt. Dapitan, Zamboanga, Mindanao, 2500 ft.; four lower from type, CMNH no. 50958, Mt. Apo, Mindanao, P.I., 2800 ft. Lower right scale 1.0 × 1.5 mm.

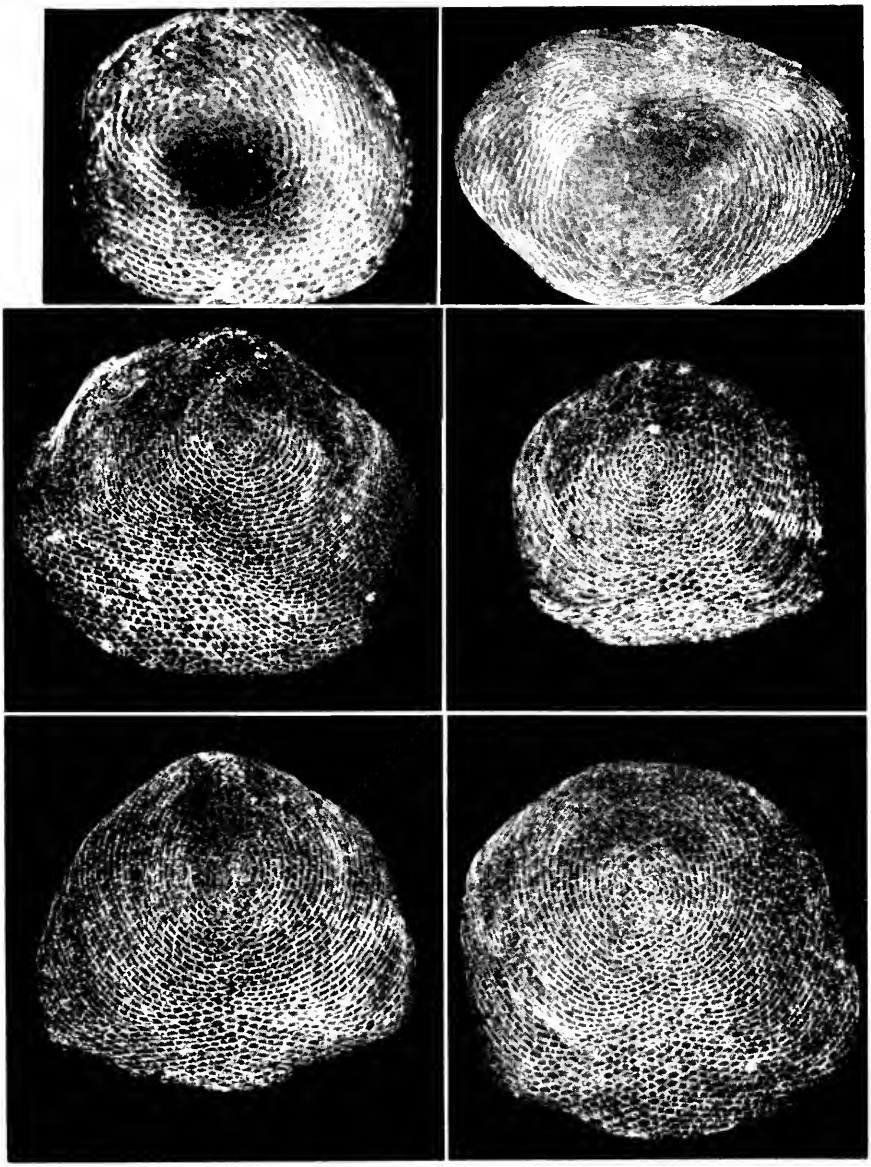

Fig. 27. *Ichthyophis paucisulcus* Taylor. Two upper scales from ZMB no. 29385, Padang, Sumatra, left one measures 1.45 × 1.7 mm. Four lower, type, USNM no. 103565, Siantar, Sumatra. Largest scale, lower right, measures 2.0 × 2.2 mm.

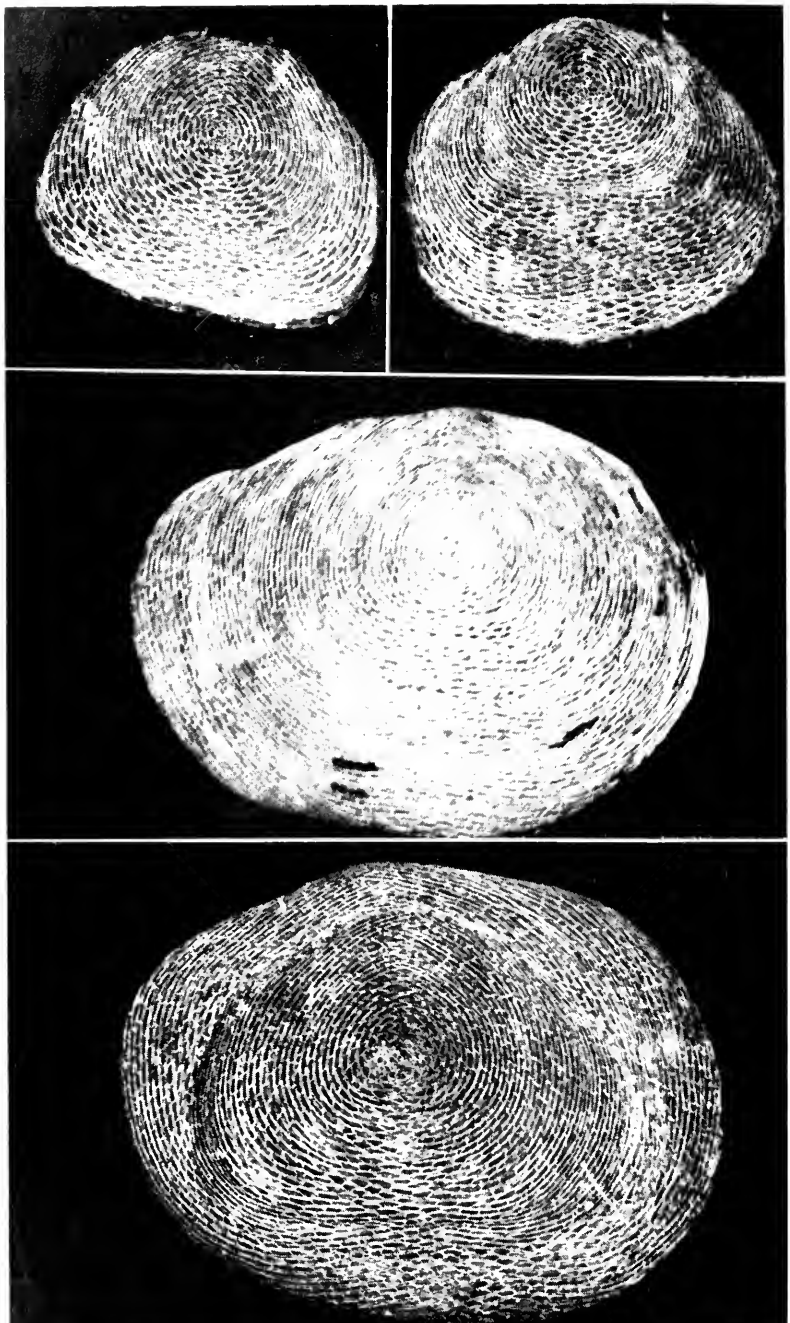

FIG. 28. *Ichthyophis peninsularis* Taylor. Scales from ZSI(C) no. 14014 ♂, from South India: two upper from near middle of body. The largest (lowest) measures 1.8 × 2.42 mm.

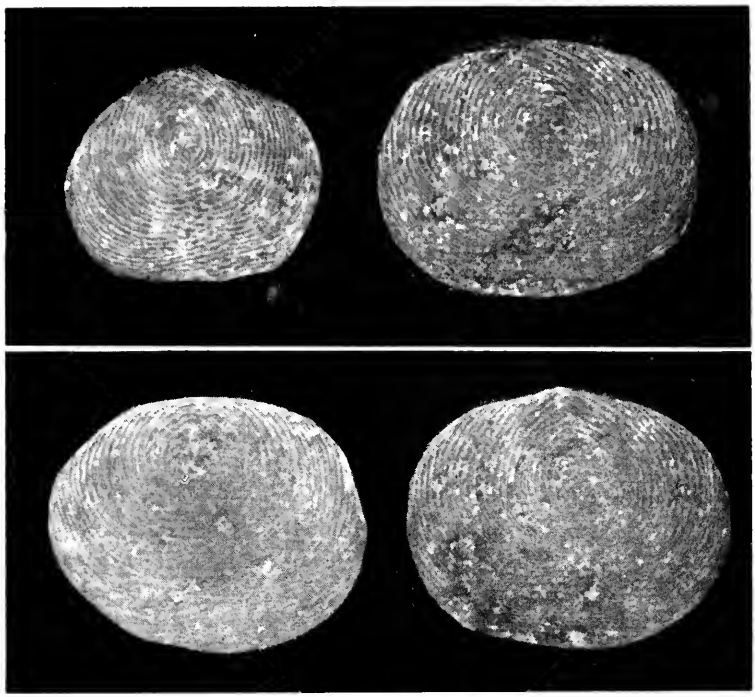

FIG. 29. *Ichthyophis pseudangularis* Taylor. Scales from MHNB no. 4412, type, "Ceylon." Largest (lower right) 0.79 × 1.1 mm.

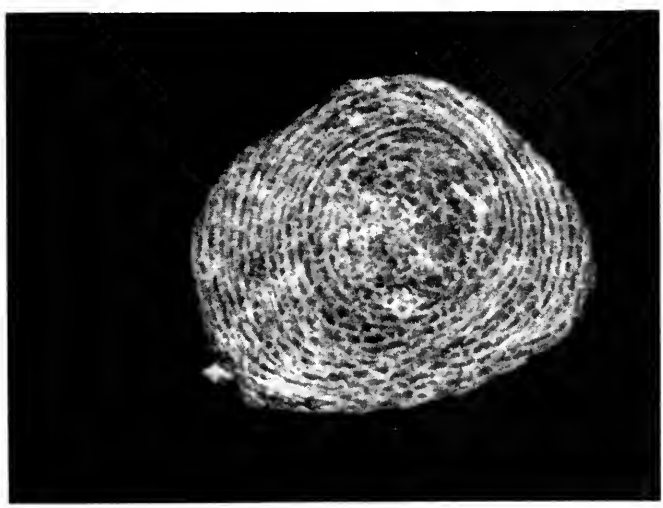

FIG. 30. *Ichthyophis sikkimensis* Taylor. Scales from MCZ no. 2685 (paratype), Rungeet Valley, British Sikkim. Scale measures about 0.7 × 0.82 mm.

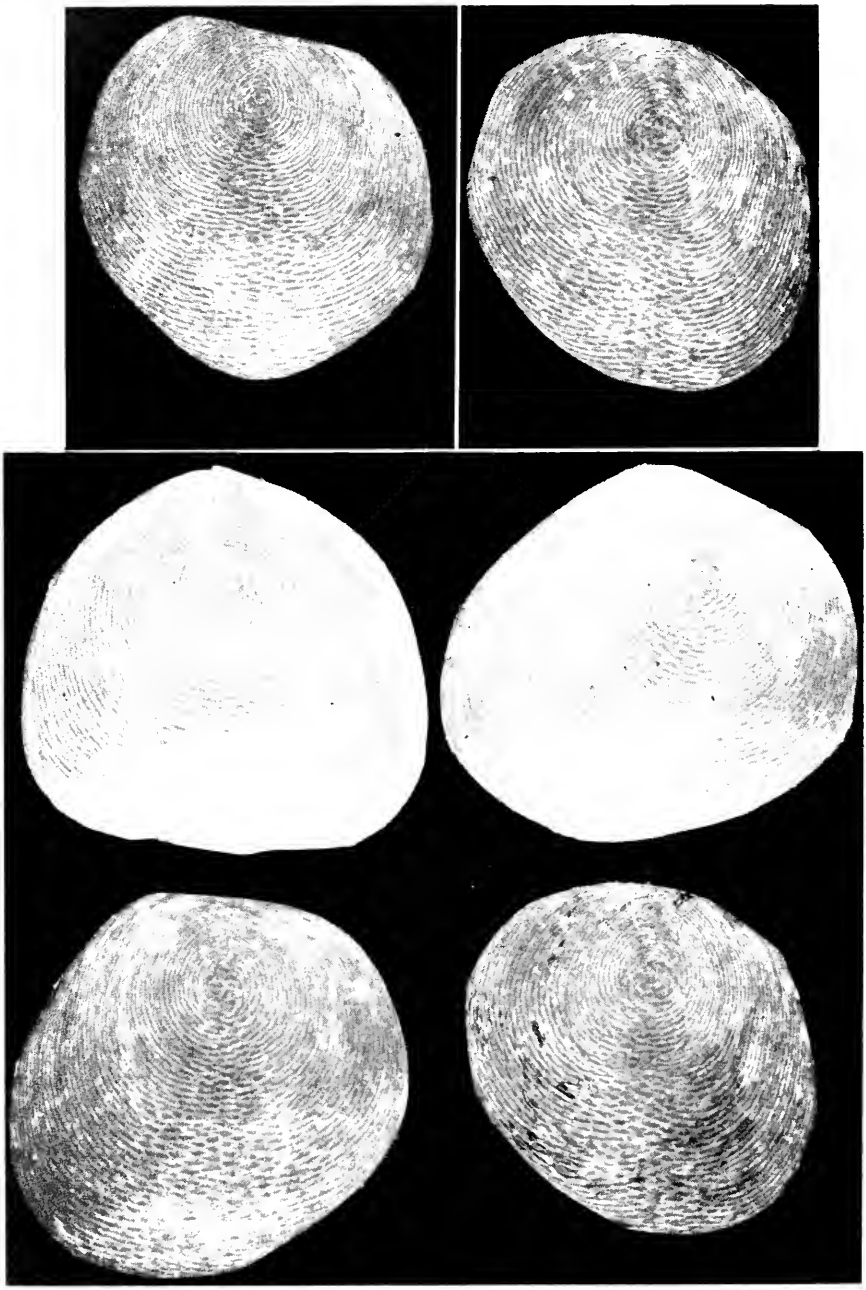

FIG. 31. *Ichthyophis subterrestris* Taylor. Scales from the type, CMNH no. 73927, Travancore, Cochin, India. Two median (largest) scales measure respectively 1.55 × 1.7 and 1.52 × 1.75 mm.

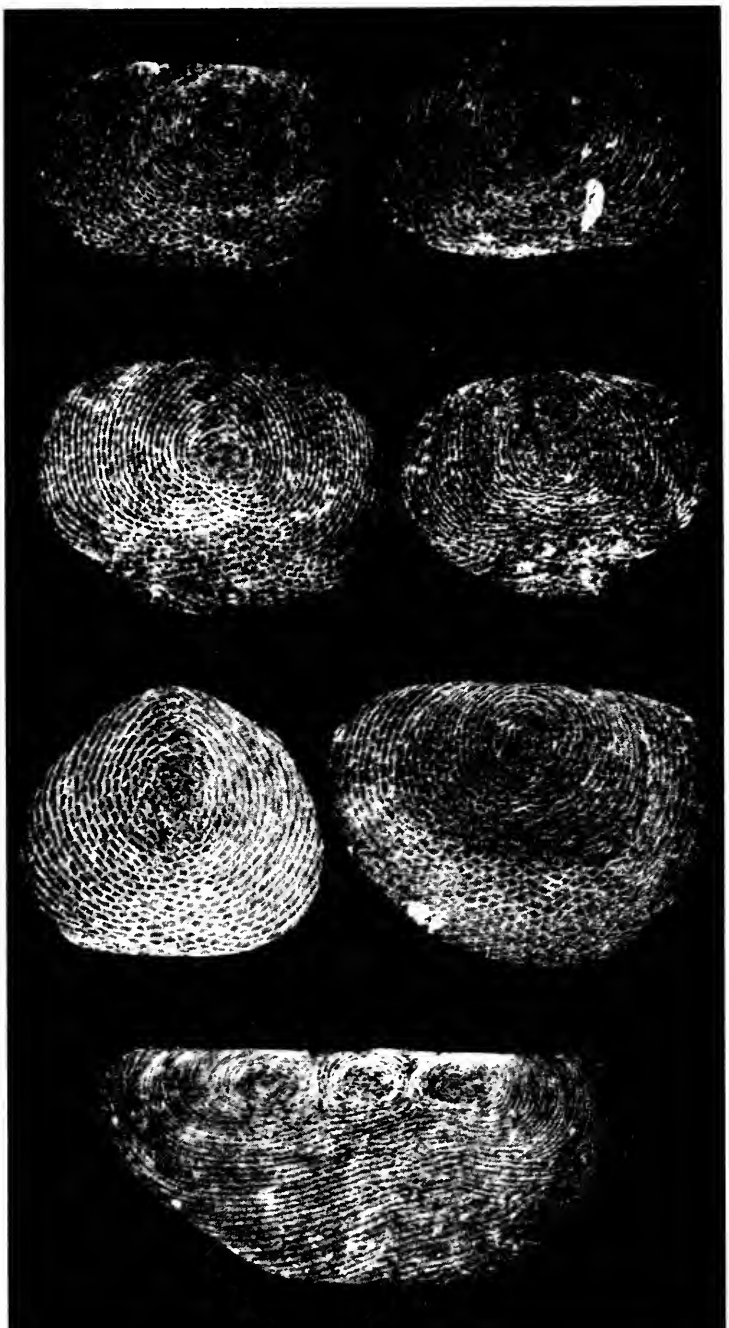

FIG. 32. *Ichthyophis sumatranus* Taylor. Four upper scales from NMW no. 9109, from Padang, Sumatra. Three lower scales, USNM no. 70672, Kapahiang, Sumatra. Lower scale (abnormal) with 3 intru.

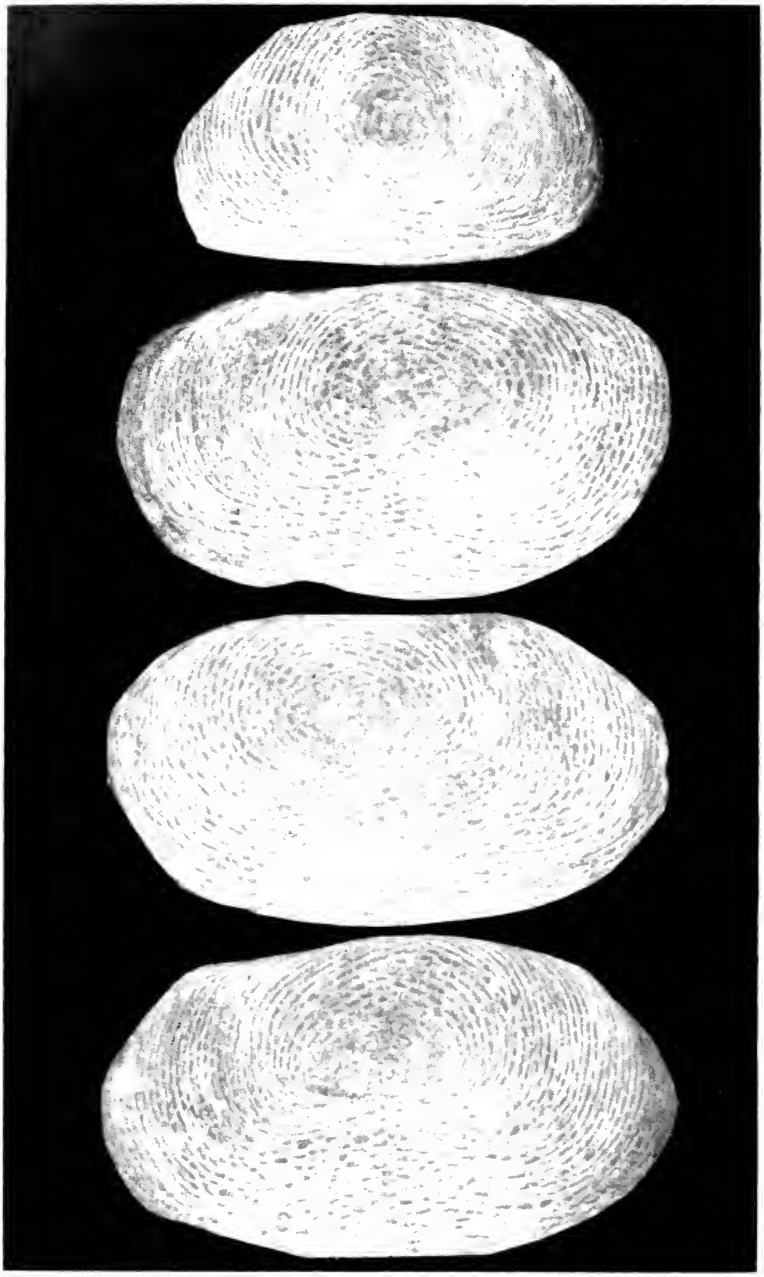

FIG. 33. *Ichthyophis supachaii* Taylor. Scales from type, FHT-HMS no. 35498, Nakhon Si Thammarat Prov., Thailand. Uppermost scale from 5th cm from end. Three largest scales about 1.1 × 1.9 mm.

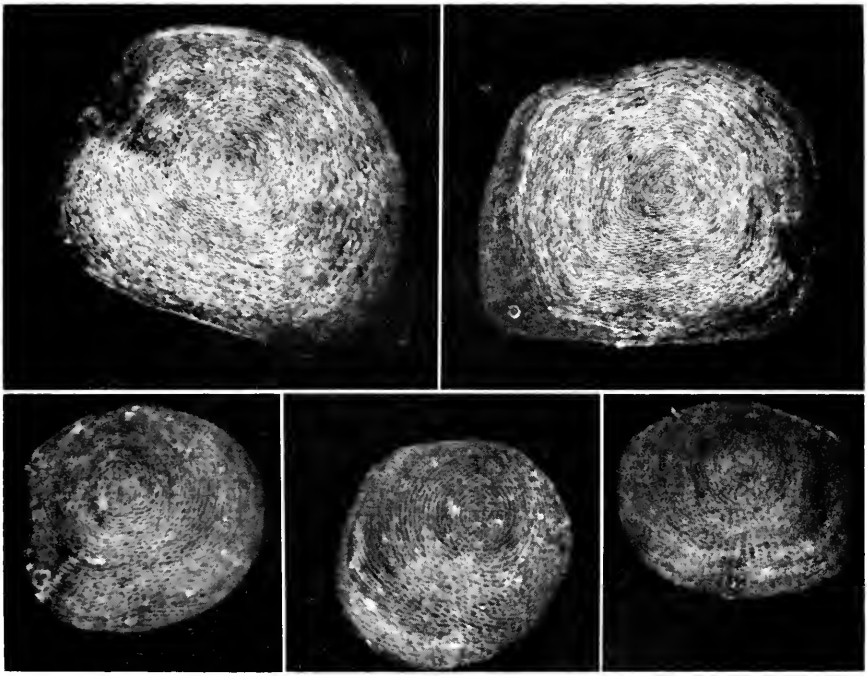

FIG. 34. *Ichthyophis tricolor* Annandale. Scales from ZSIC no. 17667, from Parambikulam, Cochin, India, "1700-3220 ft. elev." Lower three scales from about midway on the body.

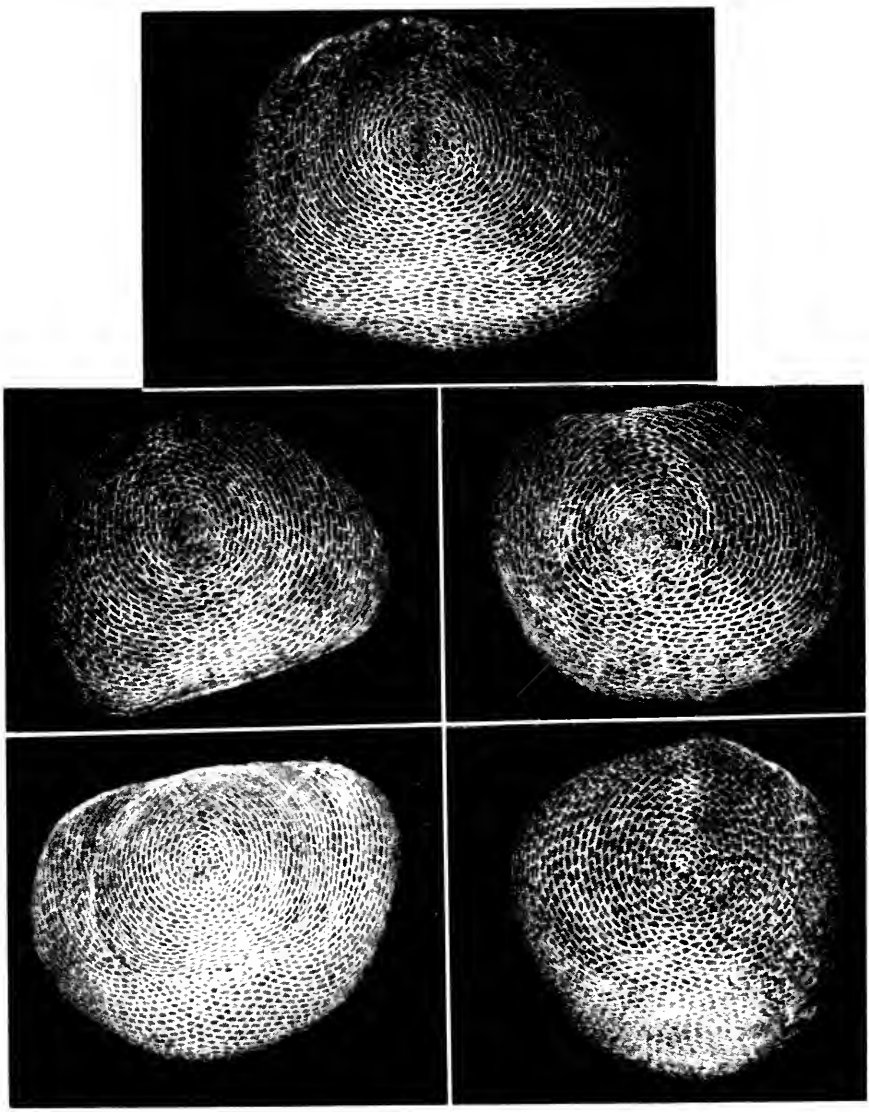

FIG. 35. *Ichthyophis taprobanicensis* Taylor. Scales from type, AMNH no. 64515, Ohiya Area, Ceylon, 5500 ft. elev. Largest scale measures 1.6 × 2.15 mm. The squamulae are very distinct and vary greatly in size and shape.

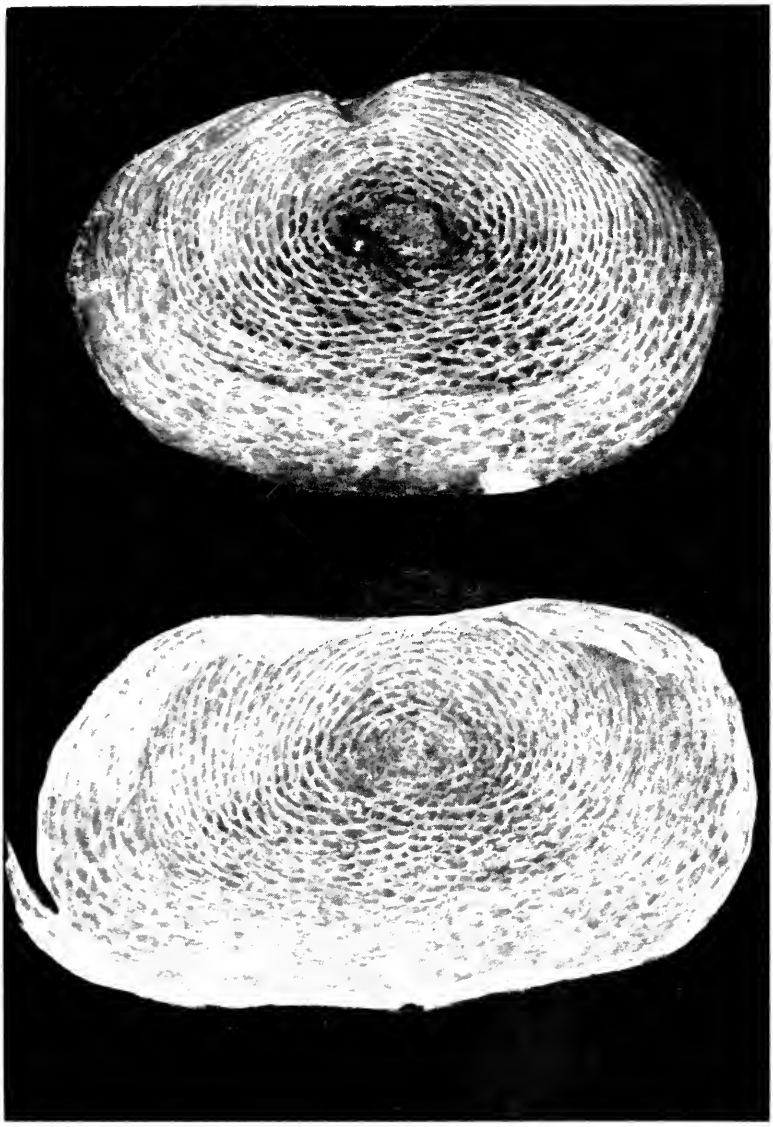

FIG. 36. *Ichthyophis youngorum* Taylor. Scales from a paratypic larva, EHT-HMS no. 35497, Doi Suthep, Chiang Mai Province, Thailand. The larva is as large as the adult specimen and is probably 2 years old. Note the presumed annular lines of growth.

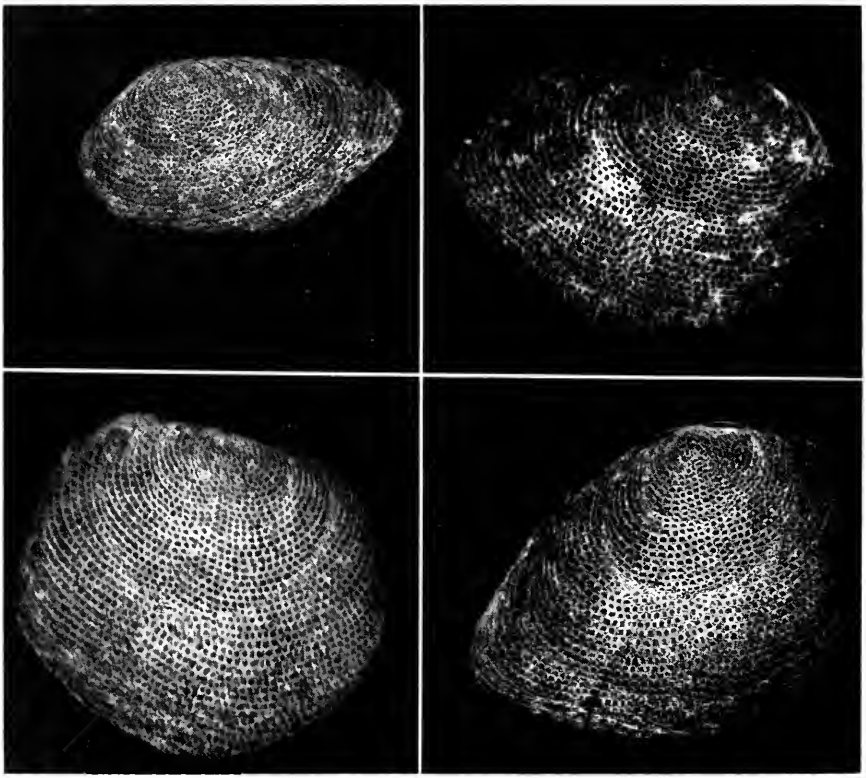

FIG. 37. *Rhinatrema bivittatum* (Cuvier *in* Guérin-Méneville). Two scales on left from type, MNHN no. 585, "Guyane," French Guiana. Two scales on right from paratype, MNHN no. 99*101, same locality. Largest scale (lower left) measures 2.0 × 2.4 mm. There is striking uniformity in the squamulae.

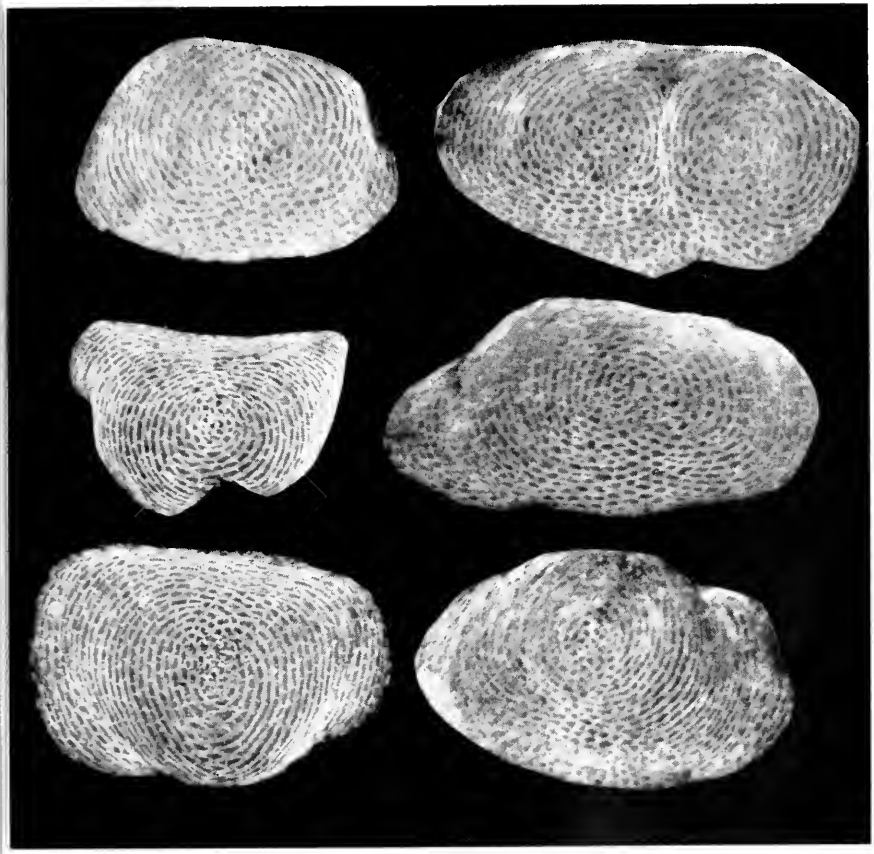

FIG. 38. *Caudacaecilia larutensis* (Taylor). Scales from EHT-HMS no. 3359, topotype, Maxwells Hill, Larut Hills, Perak, Malaya, elevation 4500 ft.

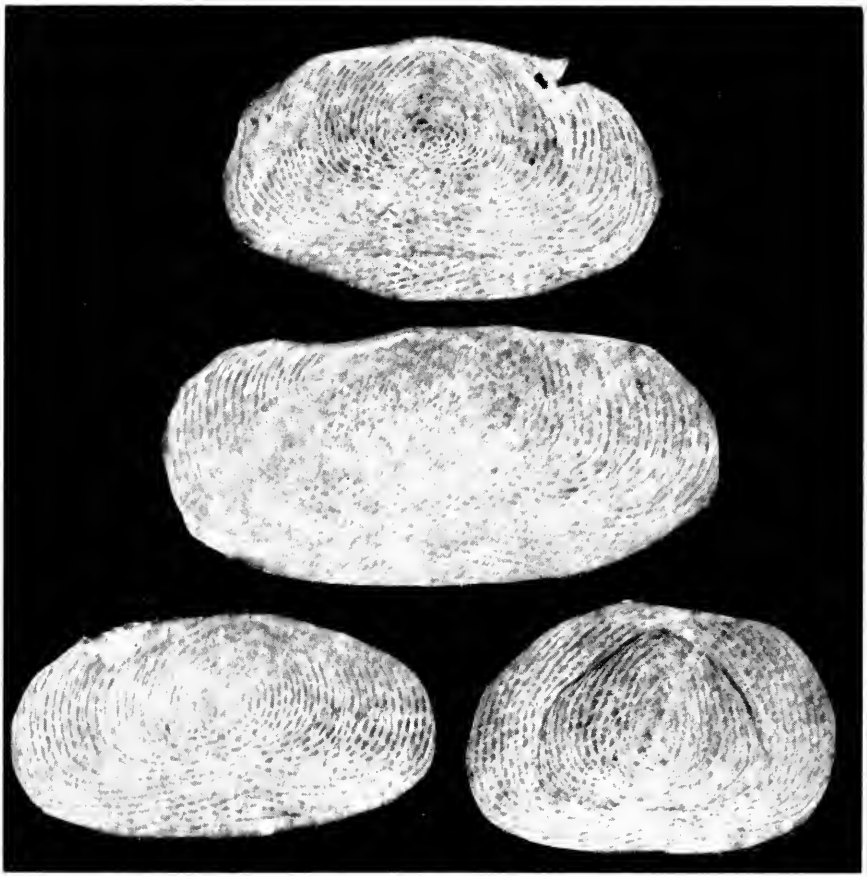

FIG. 39. *Caudacaecilia asplenia* (Taylor). Scales from EHT-HMS no. 1373, LaDoo Tin Mine, Yala (prov.), Thailand. Largest scale about 0.8 × 1.6 mm.

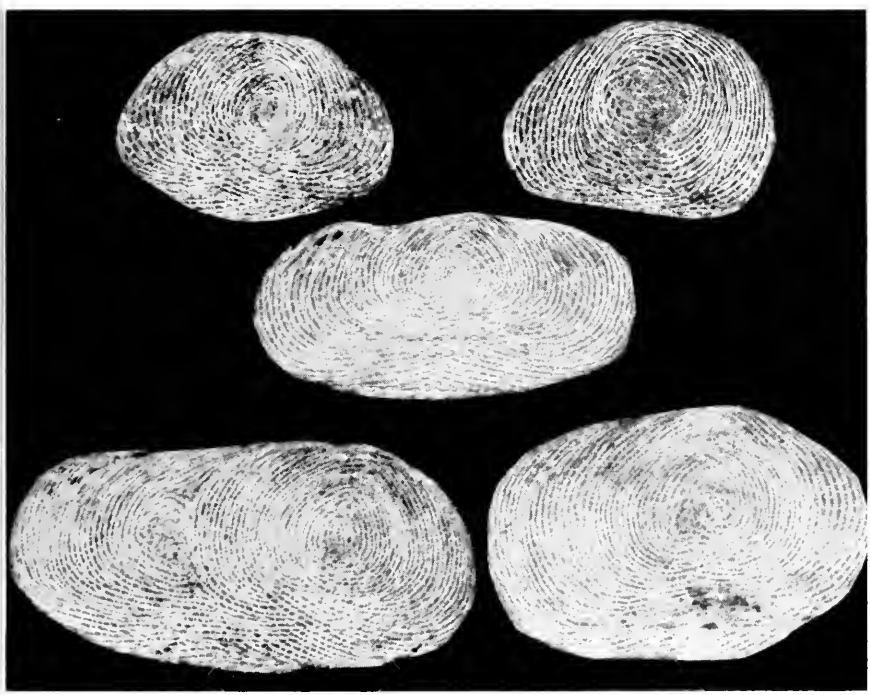

FIG. 40. *Caudacaecilia nigroflava* (Taylor). Three upper scales from a specimen lacking data; from 4th cm preceding vent. Two lower scales from type, USNM no. 129462, "within 20 miles of Kuala Lumpur, Malaya." Largest (abnormal "twin") scale, 0.9 × 2.0 mm.

FIG. 41. *Caudacaecilia patecidentida* (Taylor). Scales from type, USNM no. 70671, Kapahiang, Sumatra. Lowest scale 0.9 × 1.6 mm.

Fig. 42. *Caudacaecilia weberi* (Taylor). Scales from DSBM no. 21758 (now in CAS), from near Iwahig, Palawan, P.I. Two upper scales measure 1.0 × 1.45 and 0.8 × 1.4 mm. Largest (lower right) measures 0.85 × 1.45 mm.

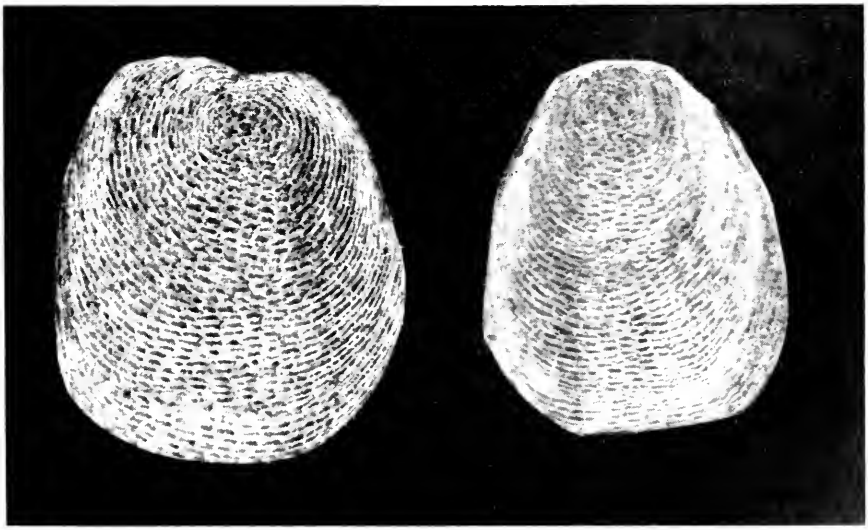

Fig. 43. *Epicrionops bicolor bicolor* Boulenger. Type, BMNH no. 78.1.25.48, from Intac, Ecuador. Scales measure 1.05 × 1.25 and 1.0 × 1.2 mm.

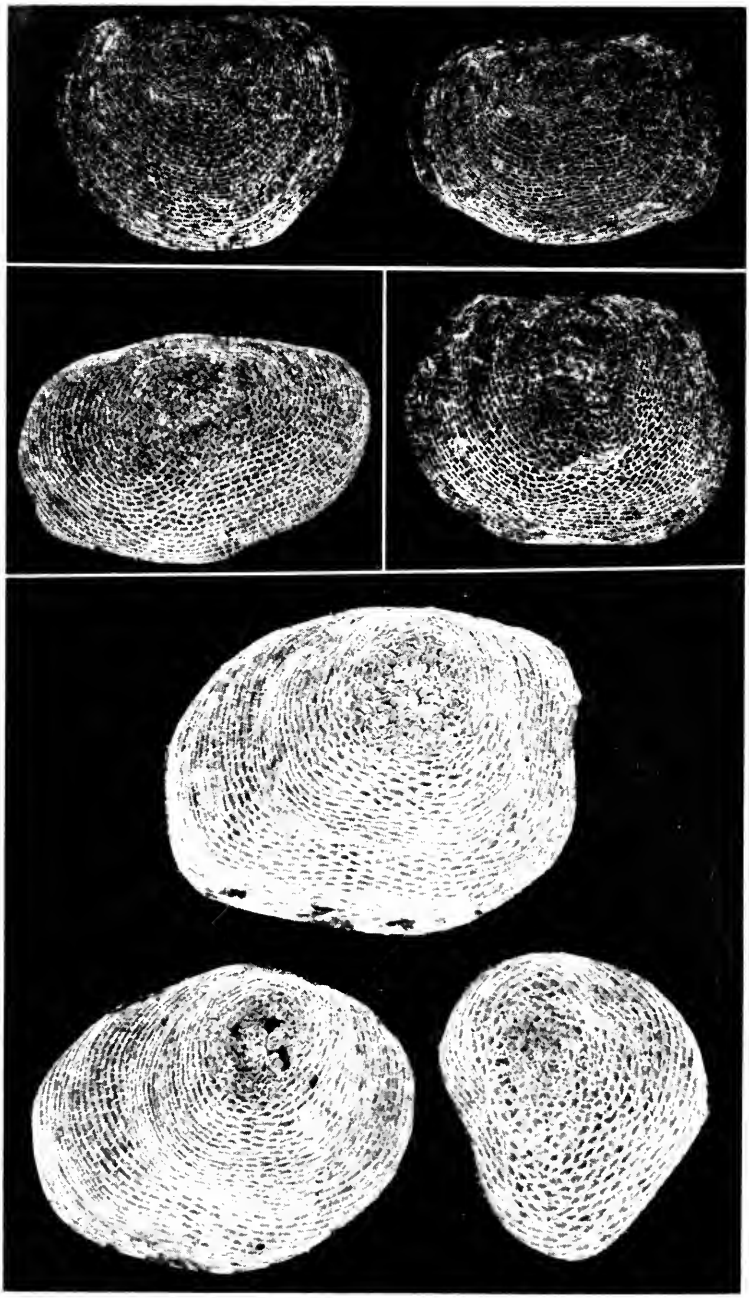

FIG. 44. *Epicrionops bicolor subcaudalis* Taylor. Four upper scales from the type, AMNH no. 17305, Chanchamayo, Río Perene, Junín, Perú, third cm preceding vent. Three lower scales, AMNH no. 42861, same locality. Largest scale, 1.56 × 2.0 mm.

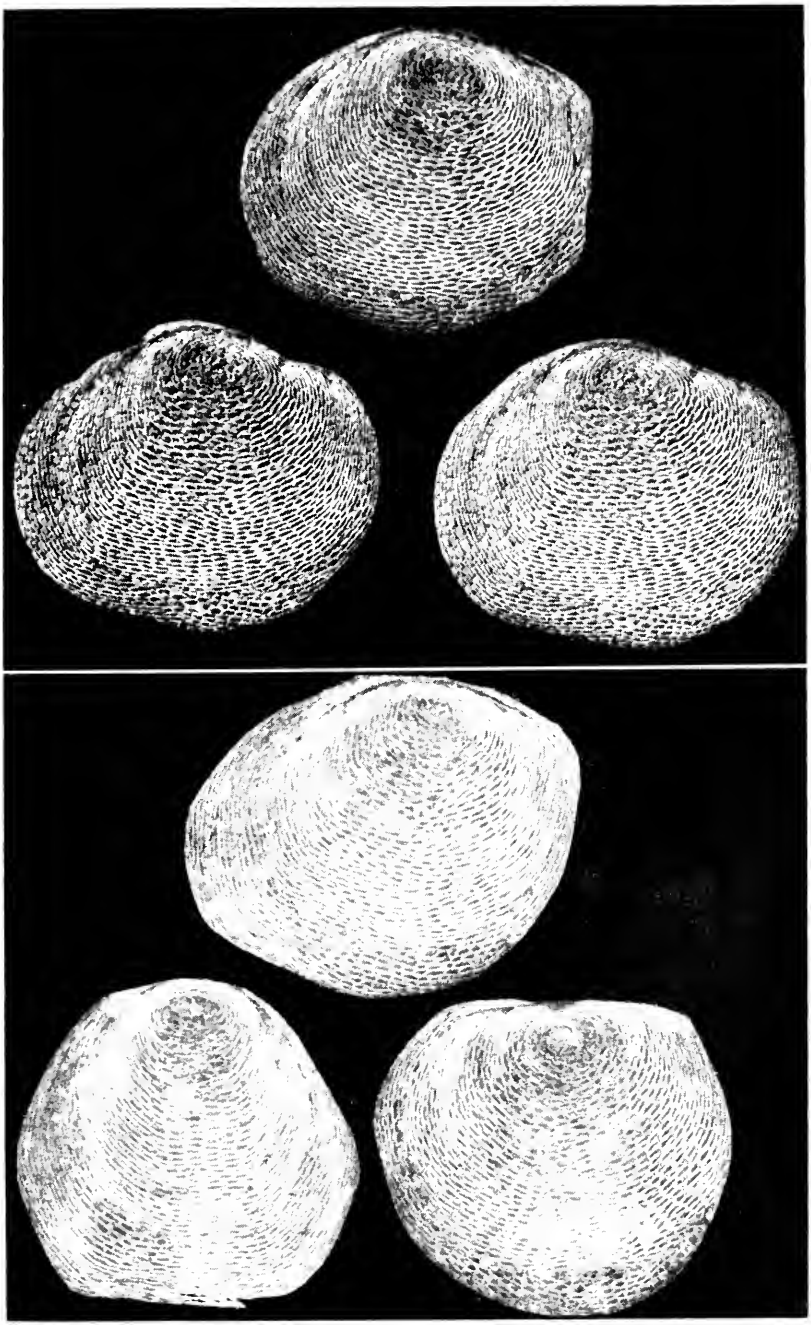

FIG. 45. *Epicrionops lativittatus* Taylor. All scales from type, AMNH no. 46205, "East Ecuador." Lower median scale measures 1.65 ×, 1.8 mm.

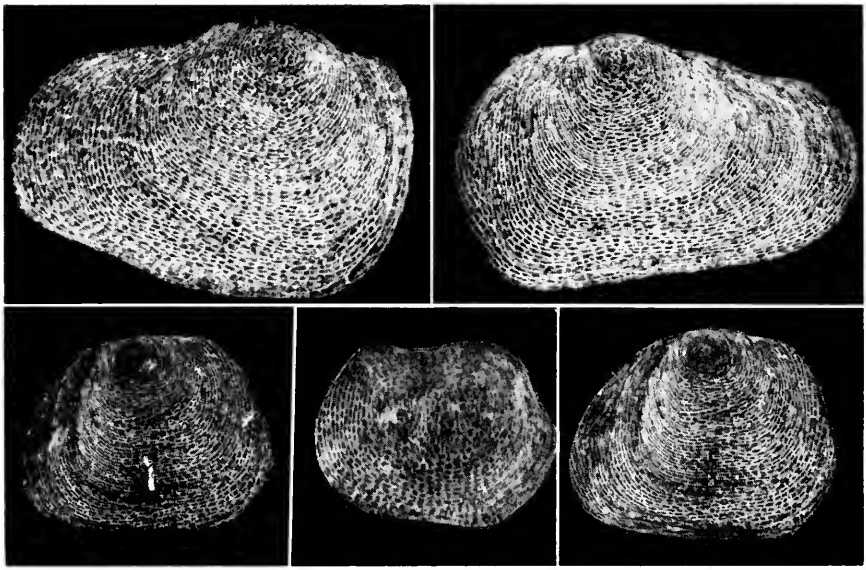

FIG. 46. *Epicrionops marmoratus* Taylor. Scales from type, BMNH no. 1956.1.17.87, Santo Domingo de los Colorados, west Ecuador. Three lower scales from 5th cm preceding vent. Upper scales measure 1.5 × 2.2 and 1.3 × 2.2 mm, respectively.

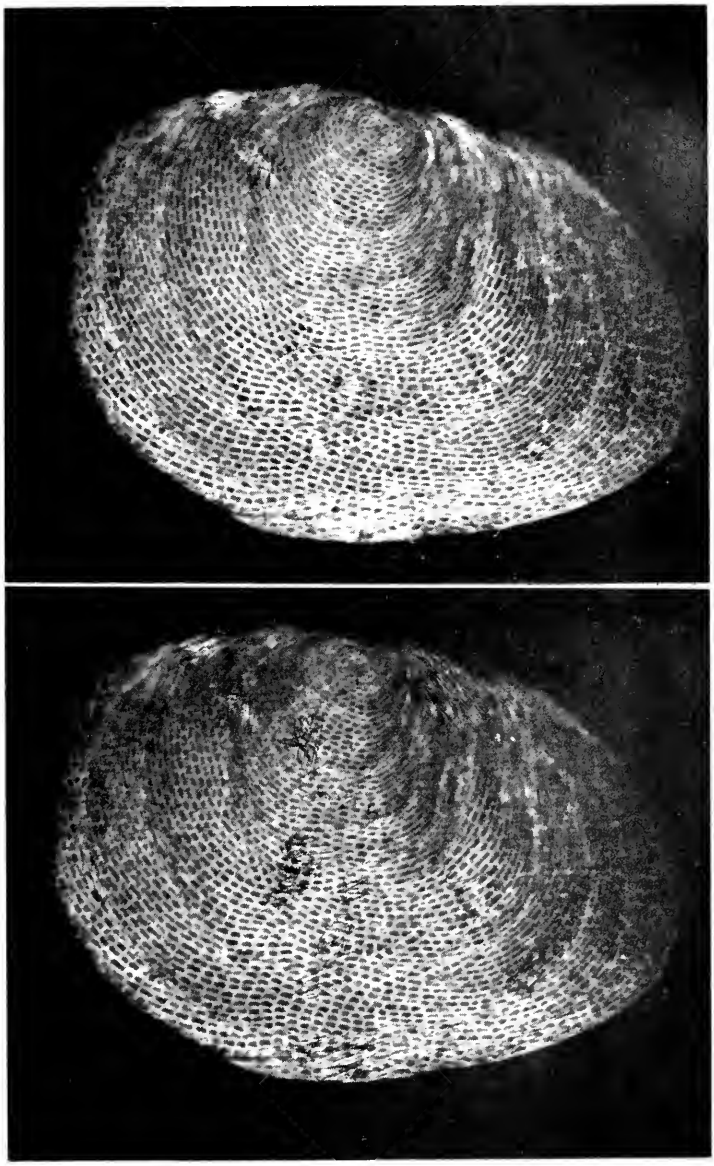

FIG. 47. *Epicrionops niger* (Dunn). Scale from neotype, UCVMB no. 5360, from El Dorado, Bolivar Venezuela. Size of upper, 1.8 × 2.4 mm.

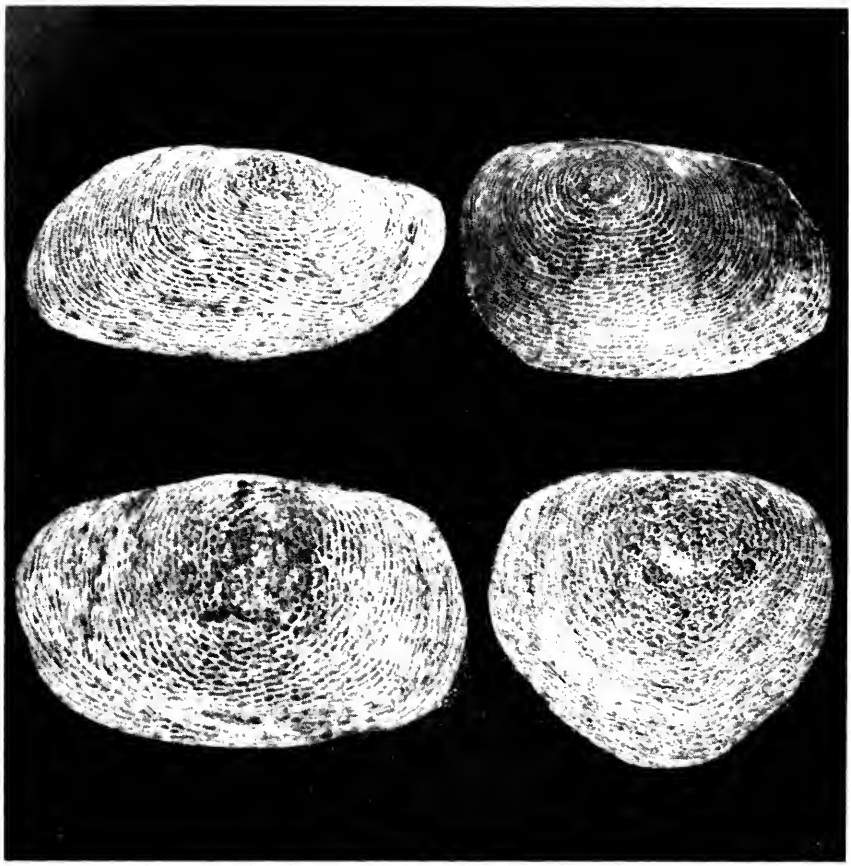

FIG. 48. *Epicronops peruvianus* (Boulenger). Scales from type, BMNH no. 1902.5.29.207 (1946. 9.6. 68), Marcapata Valley, southeastern Perú. Largest scale (lower left) 1.3 × 2.0 mm.

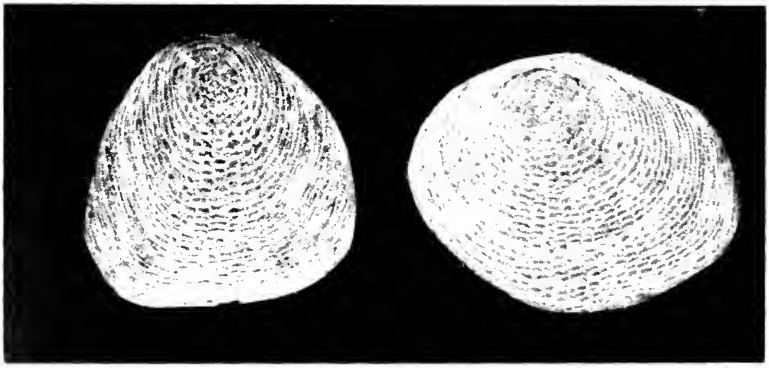

FIG. 49. *Epicronops parkeri* (Dunn). Scales from type, BMNH no. 97. 11.12.23 (1946. 9.5.61), Medellín, Magdalena River, Colombia. These measure 0.9 × 1.0 and 0.8 × 1.25 mm.

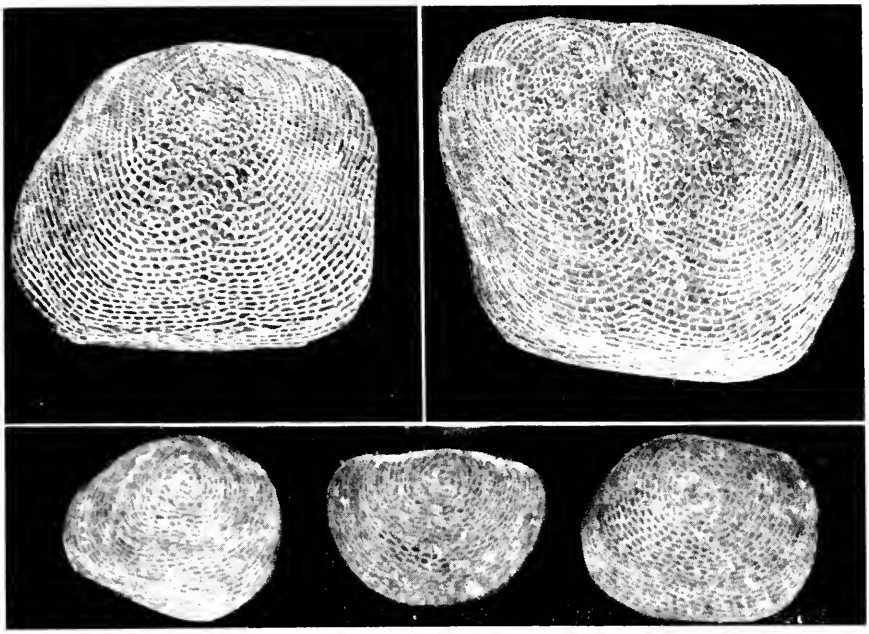

FIG. 50. *Epicrionops petersi petersi* Taylor. Two upper scales from an adult specimen, JAP no. 5979, from Ecuador. These measure 1.6 × 1.98 and 2.05 × 2.5 mm. Three lower scales from KUMNH no. 119399, same locality, a larval specimen, length 150 mm. The largest scale measures 0.58 × 0.7 mm.

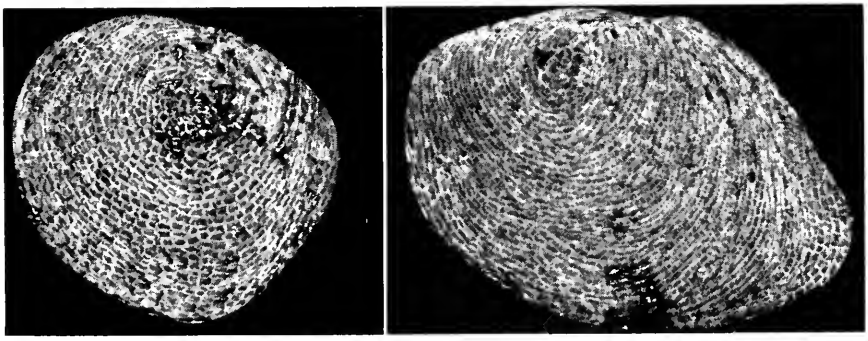

FIG. 51. *Epicrionops petersi noblei* Taylor. Scales from type, AMNH no. 1454, "sent from Juliaca, southern Perú." The larger scale measures 1.4 × 1.95 mm.

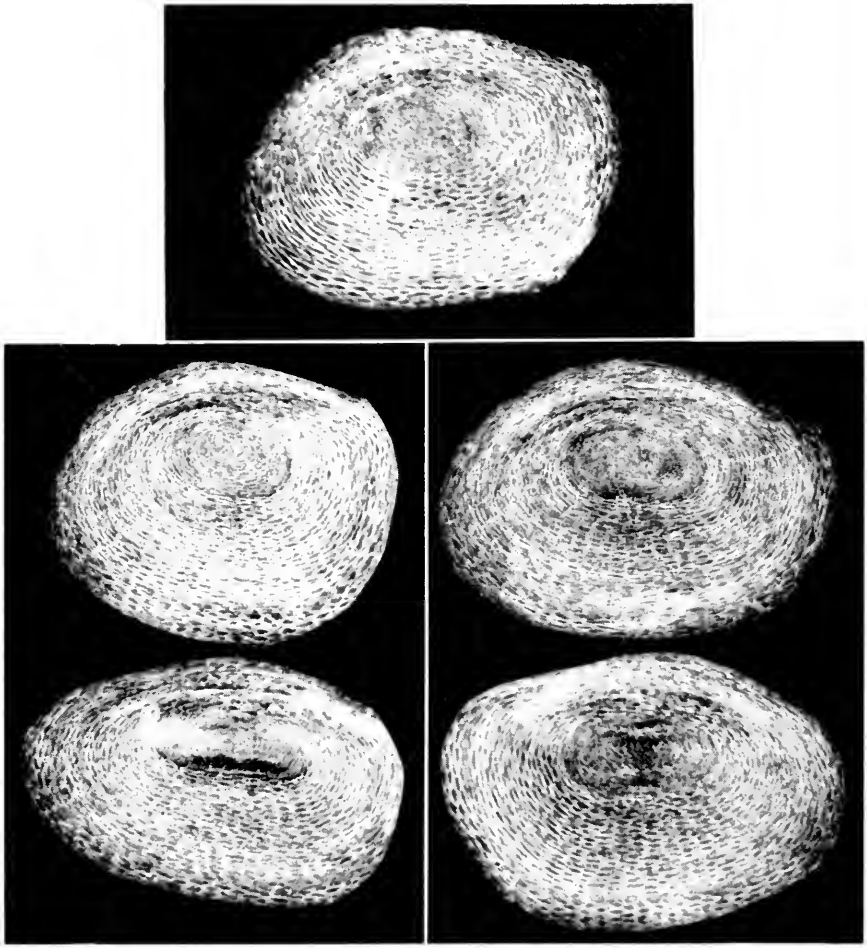

FIG. 52. *Caecilia abitagtuae* Dunn. Scales from a young specimen, KUMNH no. 119403, from 8 km NW Mera, 1300 m, Abitagua, Ecuador, very close to type-locality. Largest scale (lower right) about 2.4 × 3.2 mm. Length of specimen, 432 mm.

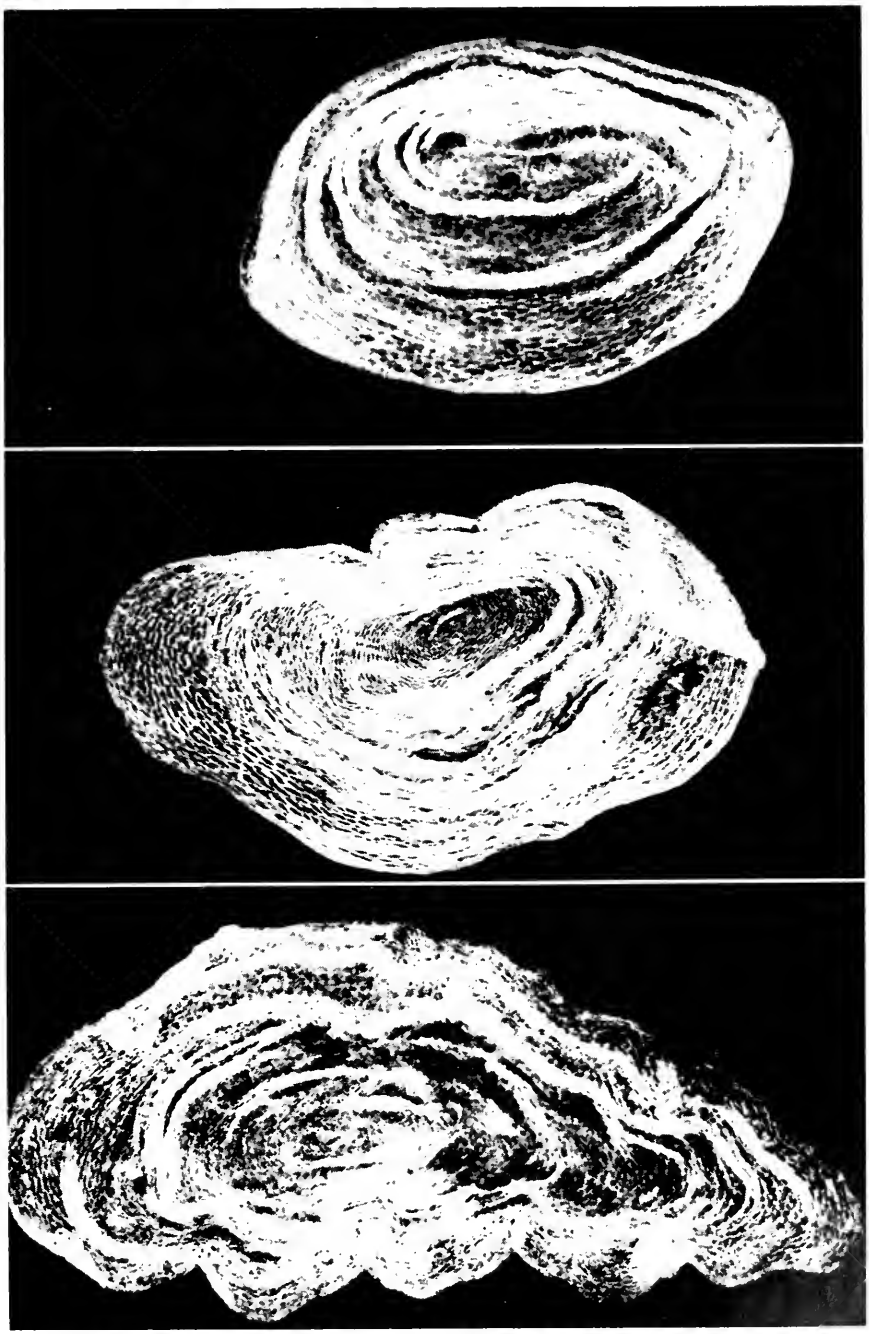

FIG. 53. *Caecilia abitaguae* Dunn. Scales from a topotypic paratype, UMMZ no. 89920, Abitagua, Ecuador. Length of specimen, 1303 mm. From a point about the 6th cm preceding vent. The lowest, largest scale is 3.2 mm wide.

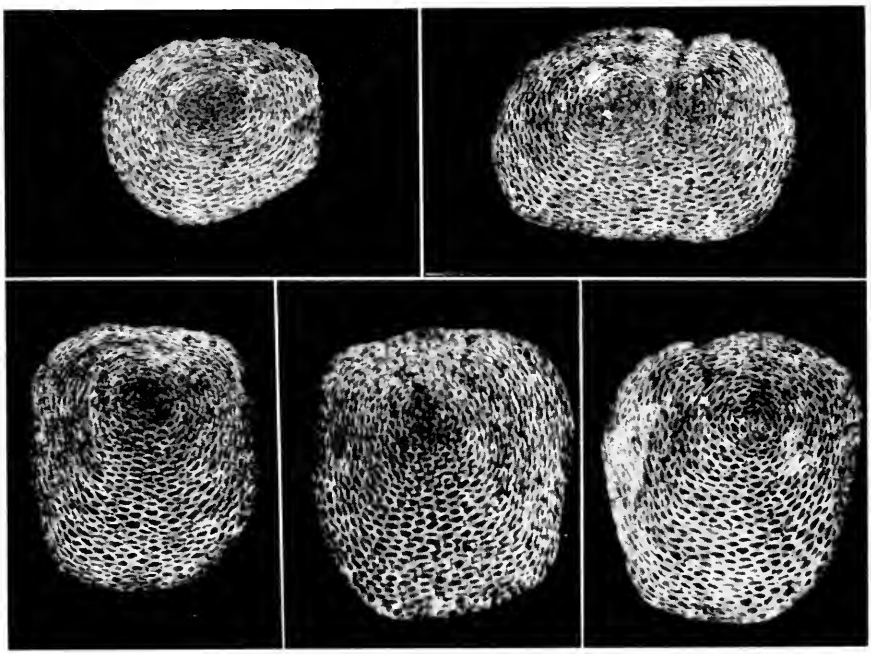

FIG. 54. *Caecilia albiventris* Daudin. Scales from KUMNH no. 1644, from "Bolivia," S.A. Two largest scales, lower row, 2.6 × 2.9 mm.

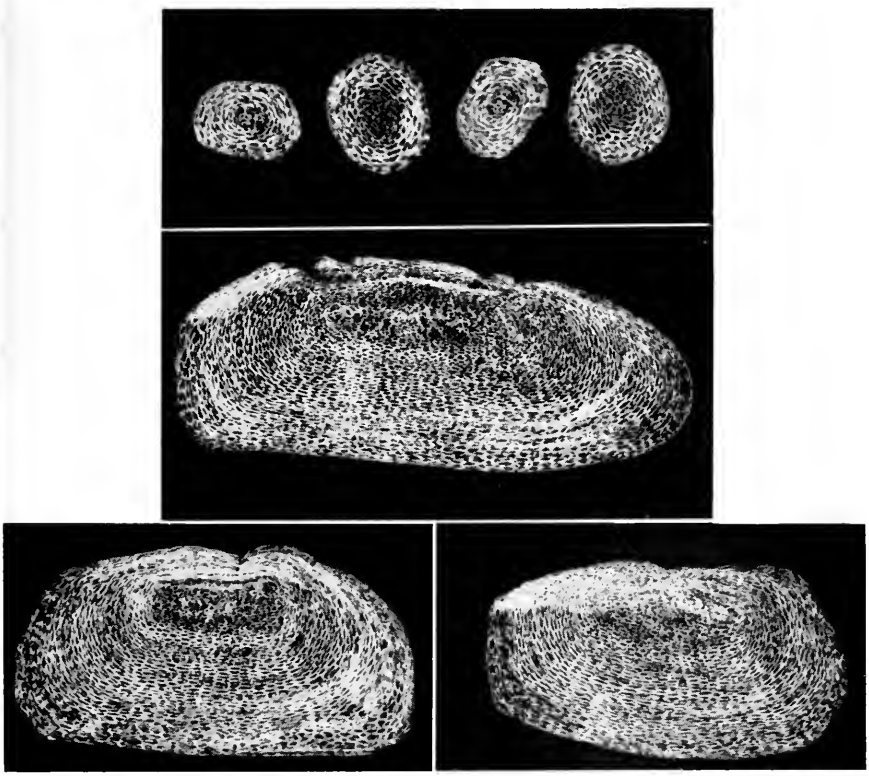

FIG. 55. *Caecilia antioquiaensis* Taylor. Scales from type, CMNH no. 69680, from Valdivia, Antioquia, Colombia. Four upper scales are subdermals from near middle of body. Largest scale 1.17 × 3.1 mm.

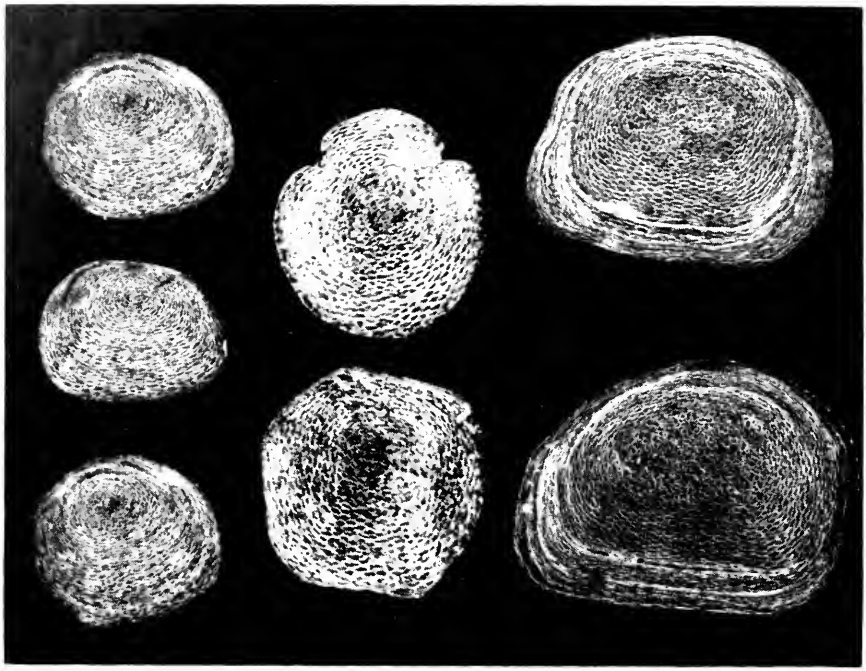

FIG. 56. *Caecilia bokermanni* Taylor. Scales from type, no. 234, Coll. Werner Bokermann, Río Bobonaza, Napo-Pastaza, Ecuador. All except two largest from 2 or 3 cm preceding vent.

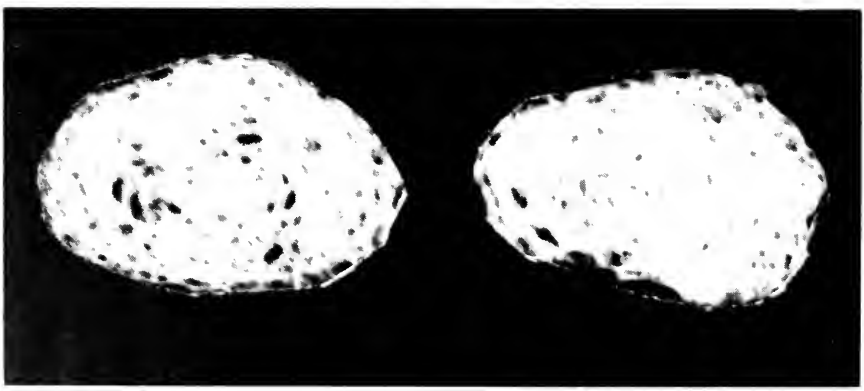

FIG. 57. *Caecilia crassisquama* Taylor. Scales from type, AMNH no. 23431, Normandia, Zuñia, Río Upana, Ecuador, 1400-1800 m; east slope of the Andes.

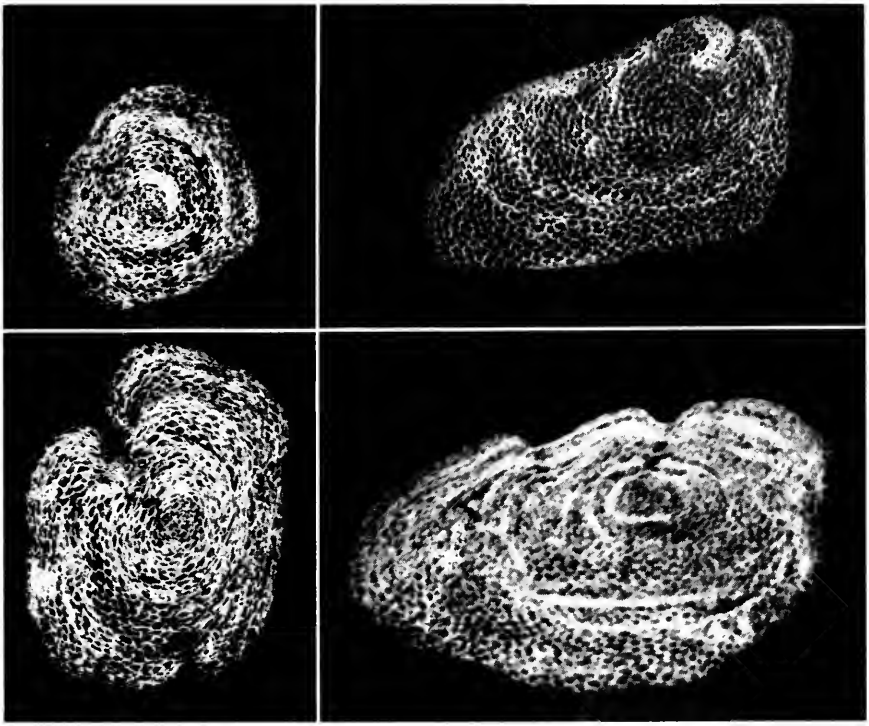

FIG. 58. *Caecilia degenerata* Dunn. Scales from paratype, AMNH no. 22570, Valle Del Río Negro, Choachí, Cundinamarca, Colombia. Scale, lower left, measures 1.25 × 1.65 mm. Others not proportional.

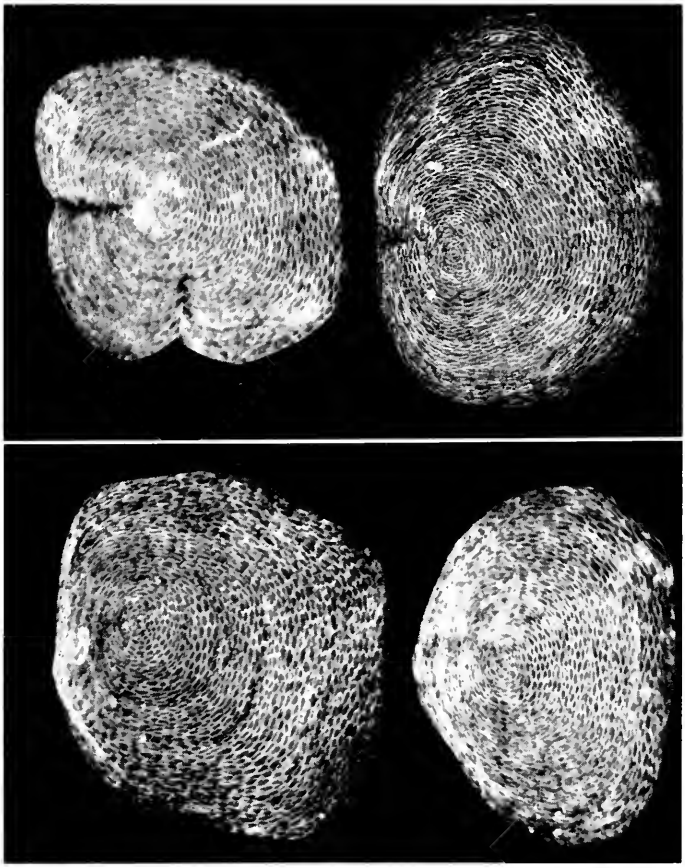

FIG. 59. *Caecilia disossea* Taylor. Scales from paratype, AMNH no. 42832, mouth of Río Santiago, Perú. Largest scale, upper left, measures 1.7 × 1.72 mm.

Fig. 60. *Caecilia dunni* Hershkovitz. Upper row, mixed scales from UMMZ no. 121037, Andagoya, Condoto, Chocó, Colombia, and from USNM no. 124261, Apagado R. drainage, Colombia. Lower row, Harvard no. 26176, Andagoya, Colombia. Largest scale (bottom center) 1.7 × 2.2 mm.

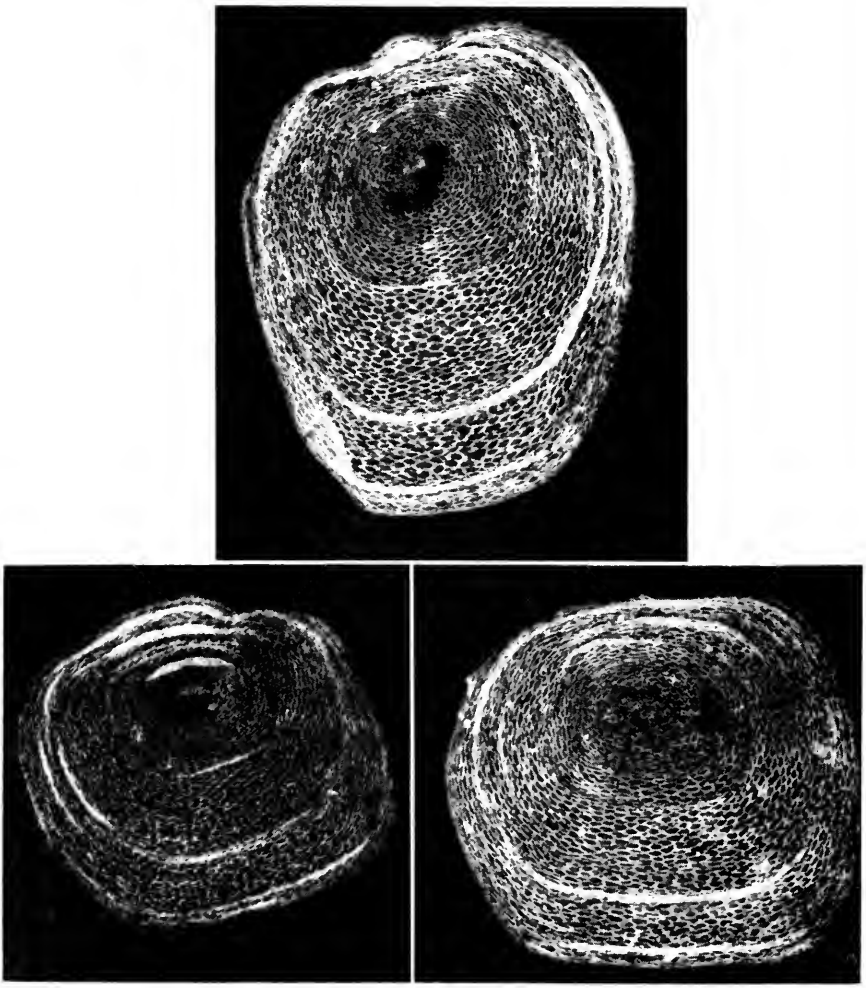

FIG. 61. *Caecilia flavopunctata* Roze and Solano. Scales from type, UCVMB no. 5358, from Albarico, Yaracuy, Venezuela. Largest scale, 1.9 × 2.4 mm.

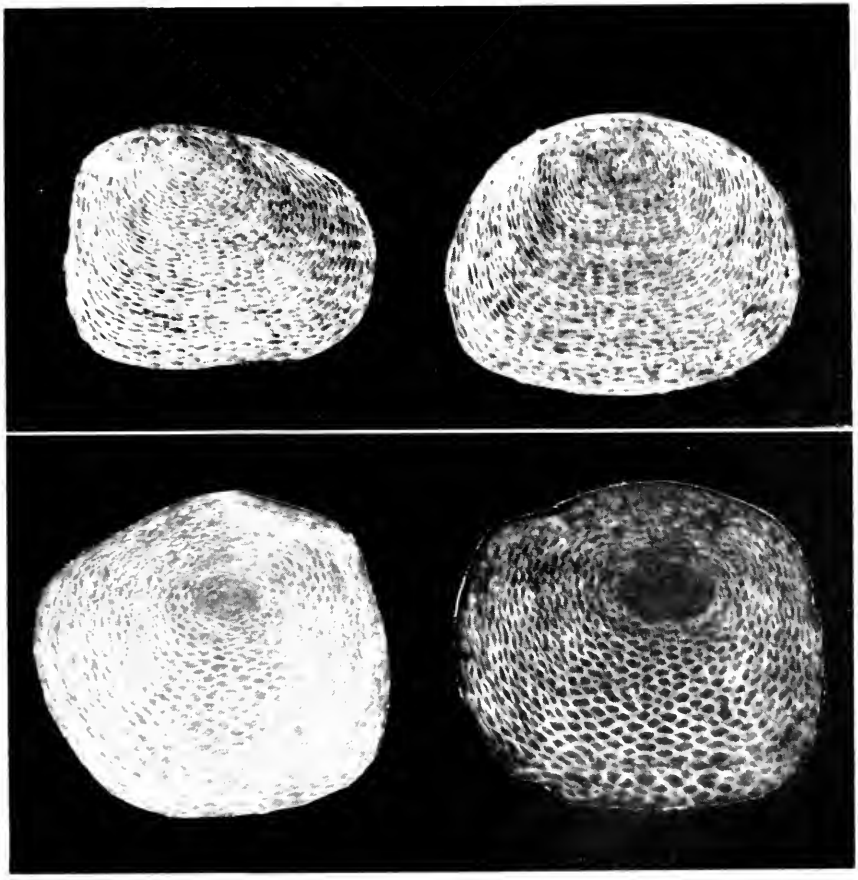

FIG. 62. *Caecilia gracilis* Shaw. Two upper scales from MNHN no. 5512, from French Guiana. Two lower scales from AMNH no. 42851, from Iquitos, Perú. These widely separated specimens show scales that look very unlike. The largest (lower right) measures 1.8 × 1.9 mm.

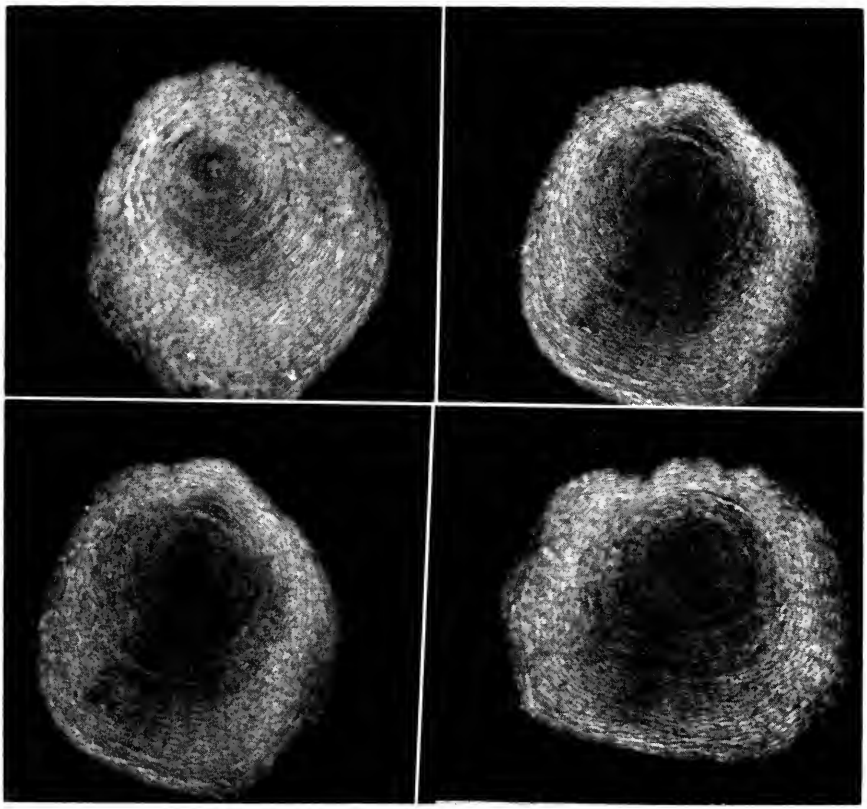

FIG. 63. *Caecilia gracilis* Shaw. ZIASL no. 223, from "Kounst Kamera," S.A. Largest scale, about 1.6 × 1.95 mm.

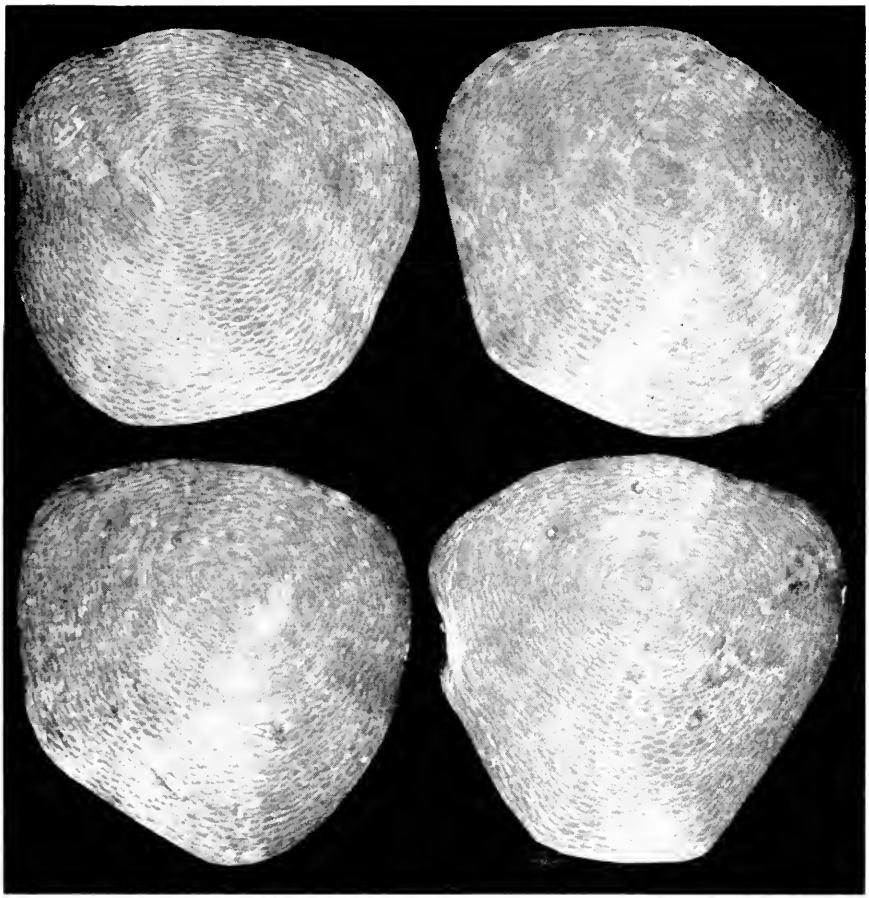

FIG. 64. *Caecilia leucocephala* Taylor. Scales from type, EHT-HMS no. 583, Wilmot A. Thompson, Coll., Virology Field Station, Río Riposa, Edo., Valle del Cauca, south of Buenaventura, Colombia. They measure about 2.0 × 2.0 mm.

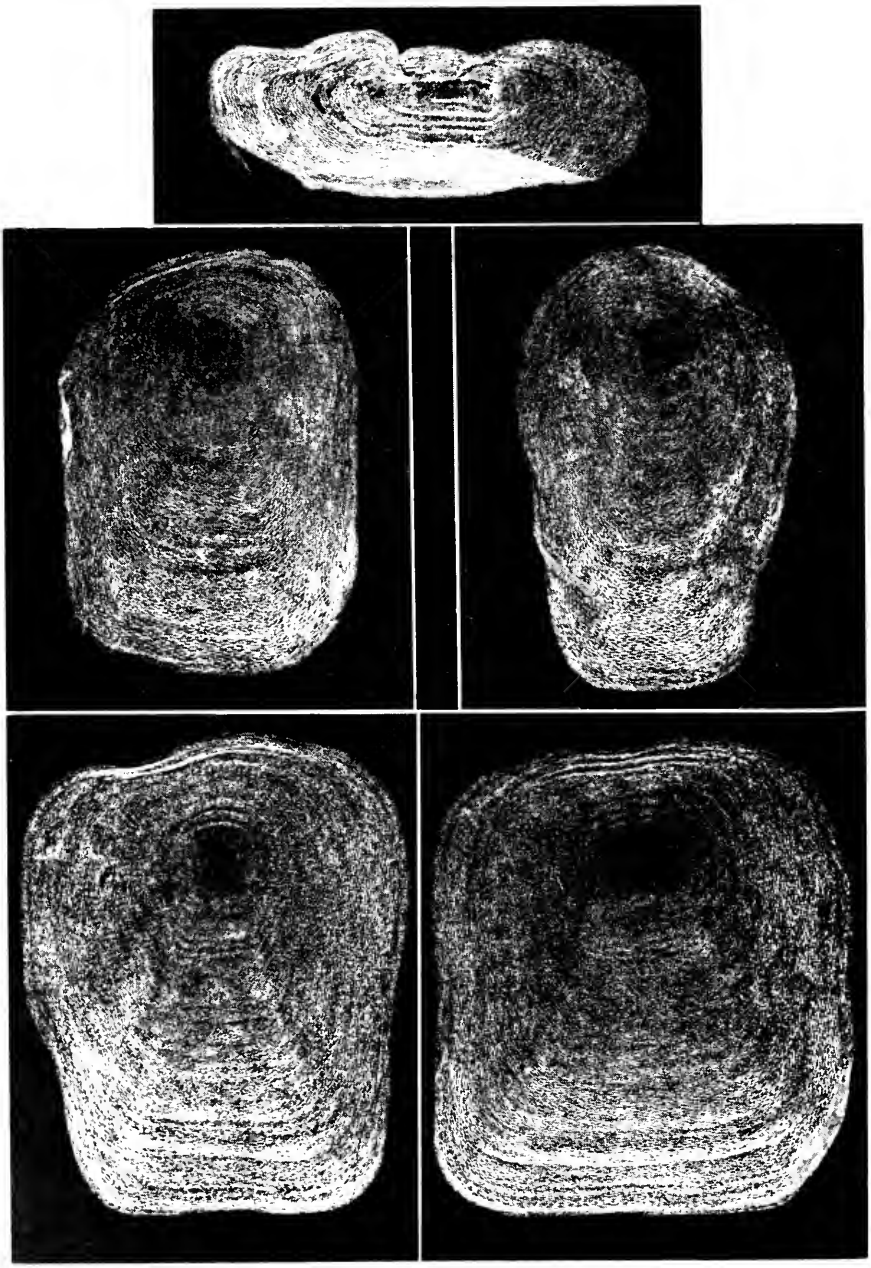

FIG. 65. *Caecilia nigricans* Boulenger. Lower four scales, from KUMNH no. 104435, western slope of Andes, Ecuador, the largest 4.2 ×, 4.5 mm. The anterior, transversely widened scale (top) is obviously very different from the posterior scales.

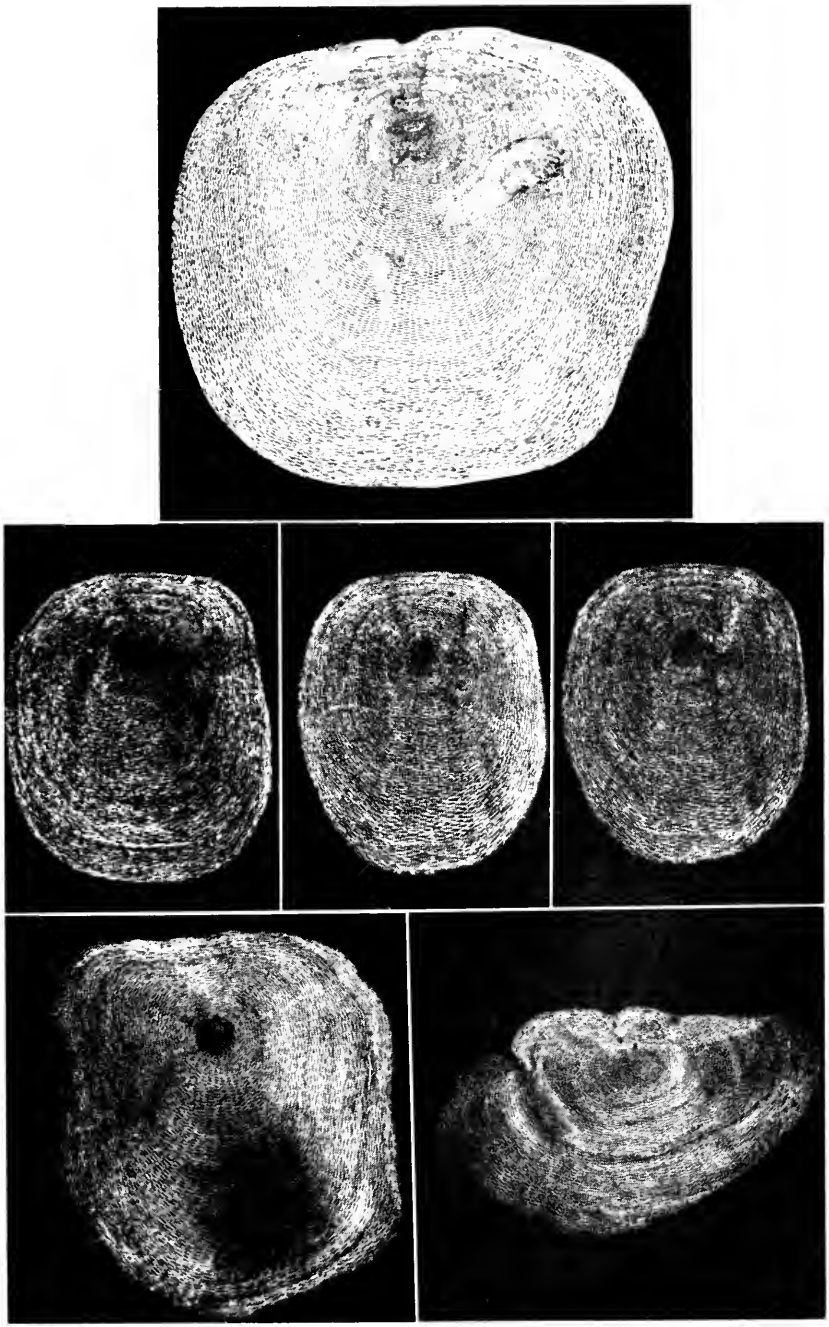

FIG. 66. *Caecilia nigricans* Boulenger. Upper, largest scale, from UMMZ no. 121035, Andagoya, Condoto area, Chocó, Colombia, measures about 3.2 × 3.5 mm. Five lower scales from BMNH no. 1901.3.29.88, Río Lita, NW Ecuador.

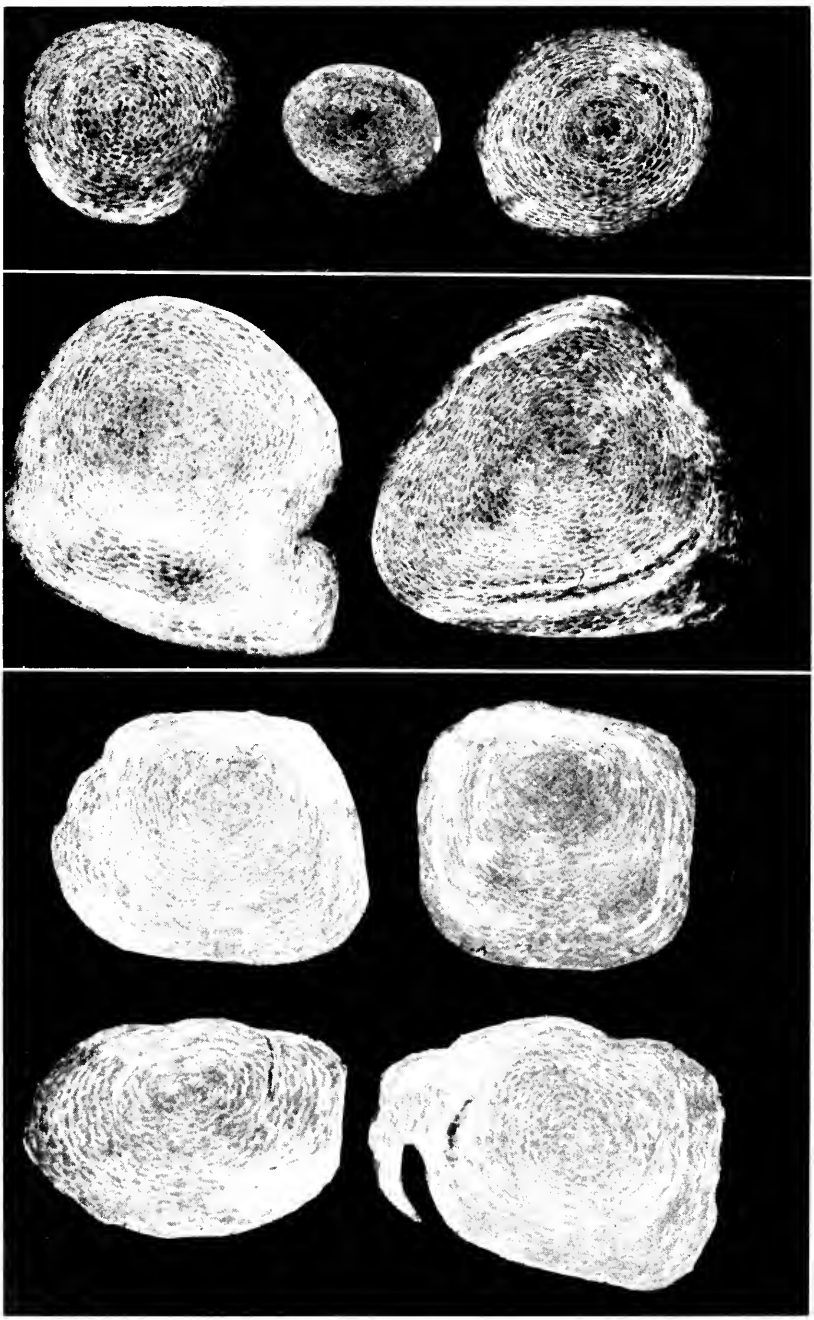

FIG. 67. *Caecilia occidentalis* Taylor. Five upper scales from type, EHT-HMS no. 4665, Popayán, Cauca, Colombia. Three upper scales are subdermals from near middle of body, 0.4 to 0.6 mm in greatest dimension. Four lower scales from ANSP no. 25568, from Popayán, Cauca, Colombia.

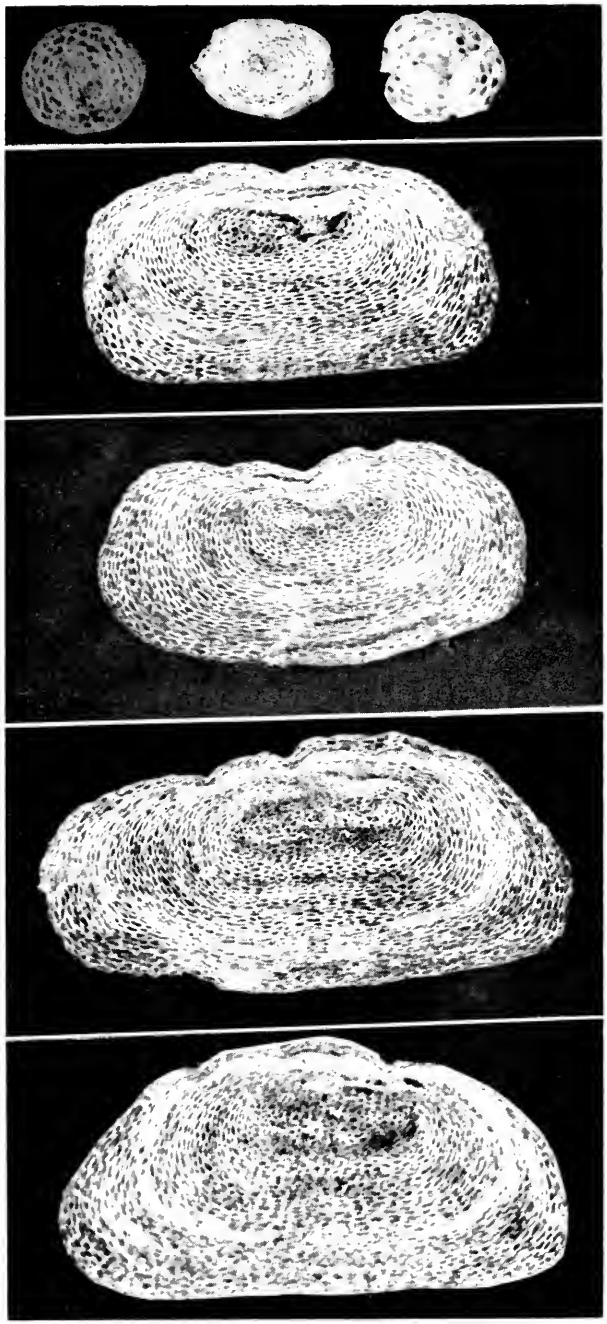

FIG. 68. *Caecilia pachynema* Günther. Scales from NMW no. 9121, from St. Javier, Ecuador. Three upper are subdermal scales from near middle of body. Lowest scale measures about 1.8 × 3.6 mm.

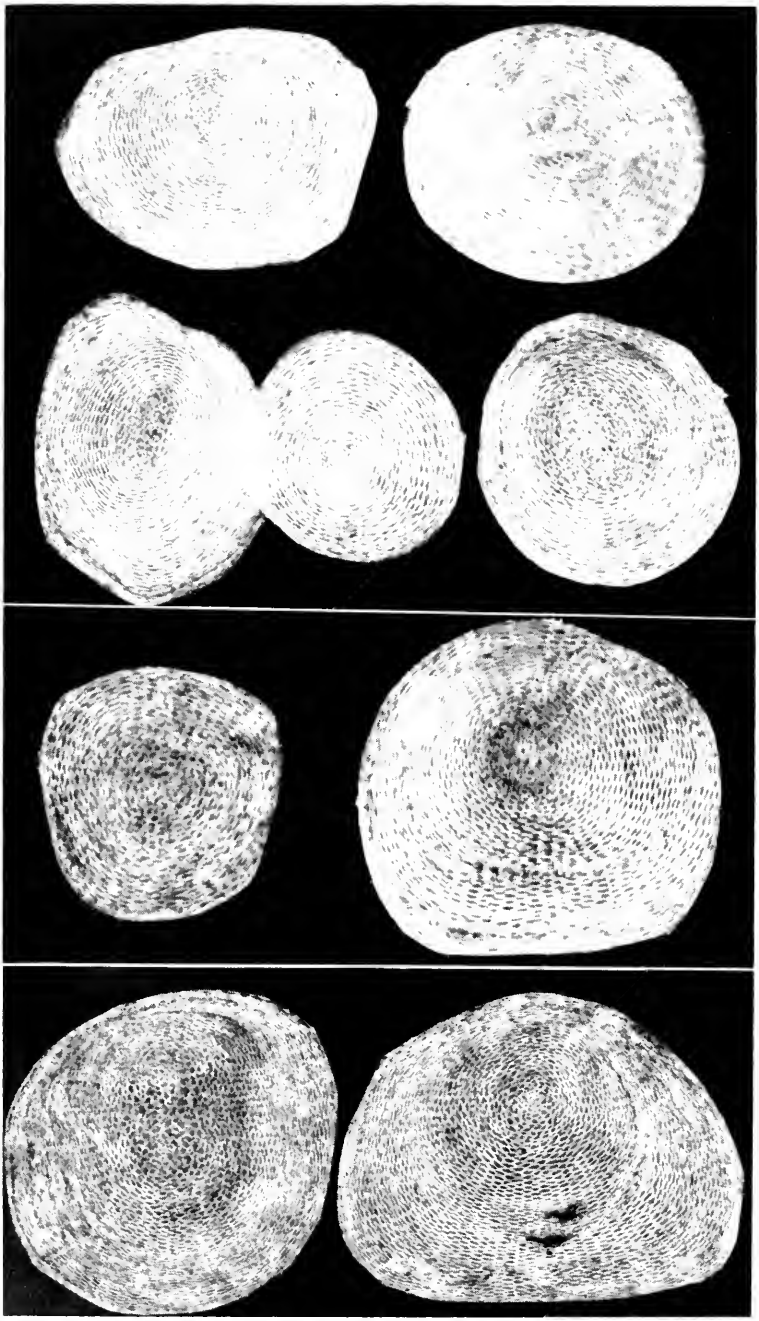

FIG. 69. *Caecilia perdita* Taylor. Upper seven scales from paratype, AMNH no. 13678, Río Quesado, Río Atrato, Colombia. Two lower scales from no. 113, Thornton collection, Río Raposo, Valle del Cauca, Colombia. Largest scale (lower right), 1.9 × 2.4 mm.

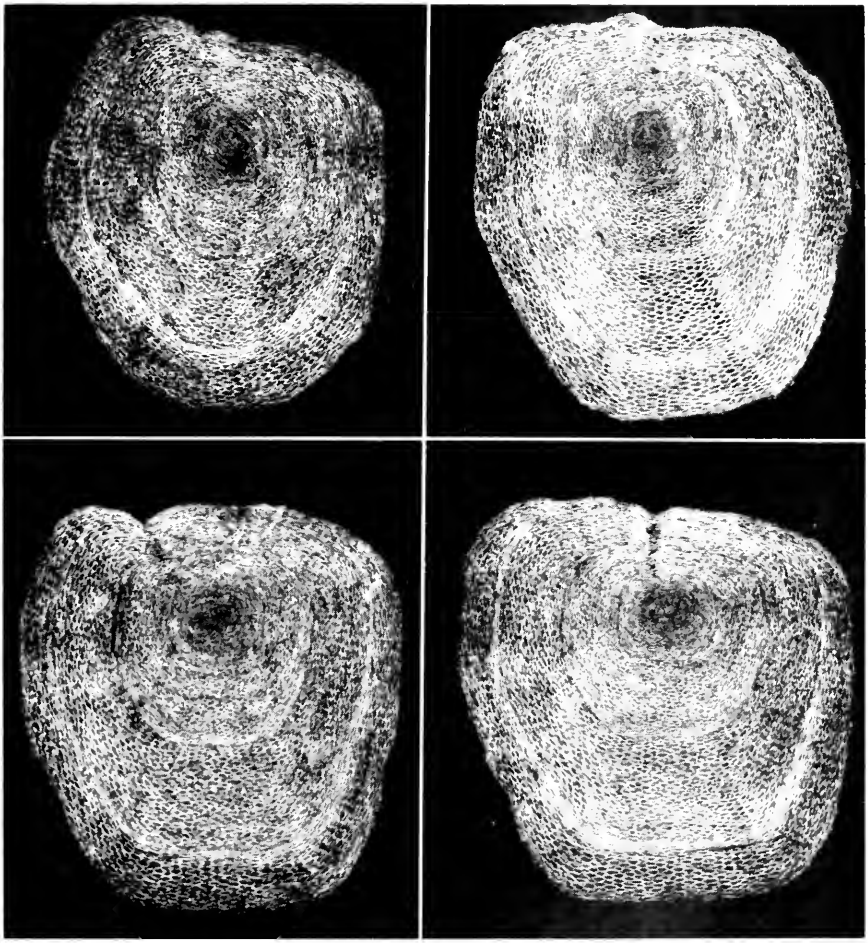

Fig. 70. *Caecilia pressula* Taylor. Scales from type, AMNH no. 49475, Marudi Mts., Guyana. The largest (lower right) measures about 2.3 × 2.3 mm.

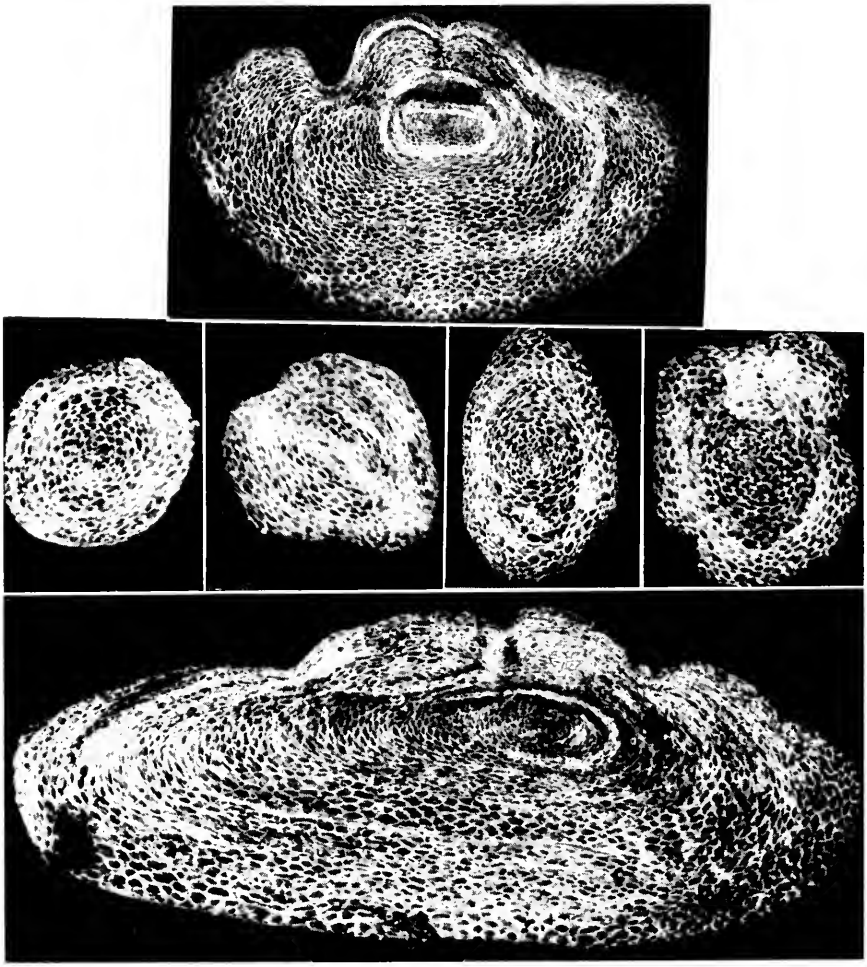

FIG. 71. *Caecilia subdermalis* Taylor. Scales from type, ANSP no. 25570, Moscopán, Cauca, Colombia. Lower one from 3 cm preceding vent; about 1.4 × 3.3 mm. Magnifications not proportional.

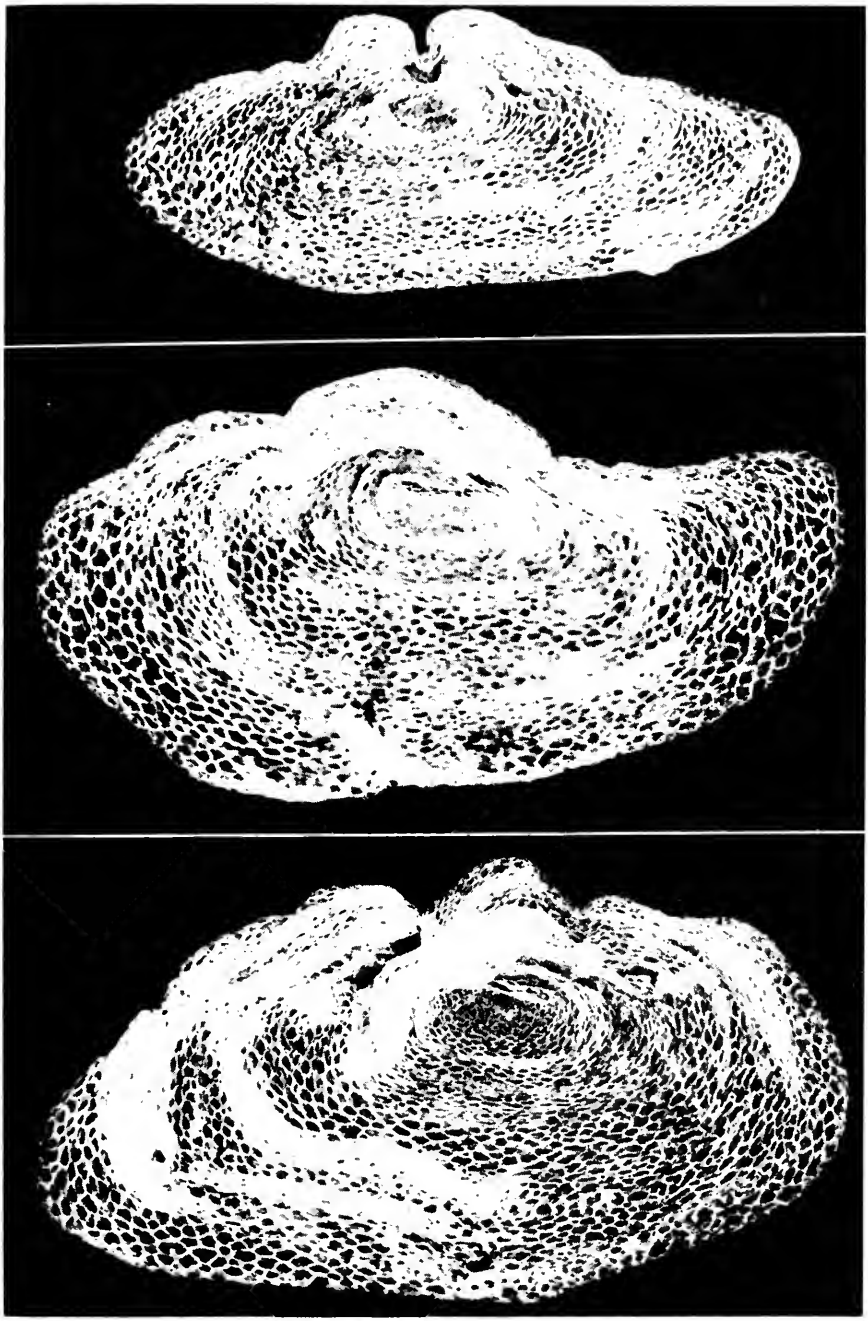

FIG. 72. *Caecilia subdermalis* Taylor. Scales from type, ANSP no. 25570, Moscopán, Cauca, Colombia, from third cm preceding vent. Width of lowest scale 2.8 mm.

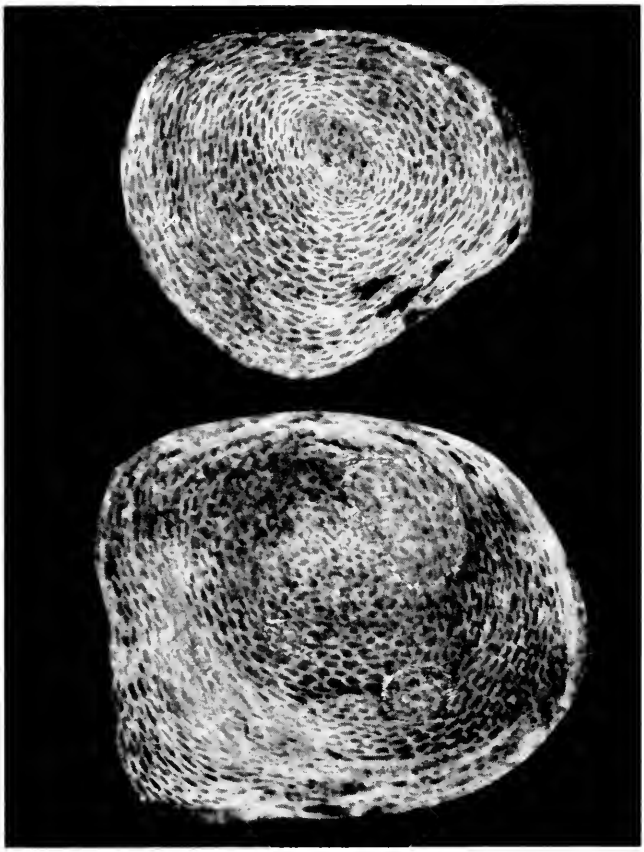

FIG. 73. *Caecilia subnigricans* Dunn. Scales from type, ANSP no. 4921, Magdalena River, Colombia. Largest scale about 1.7 × 2.0 mm.

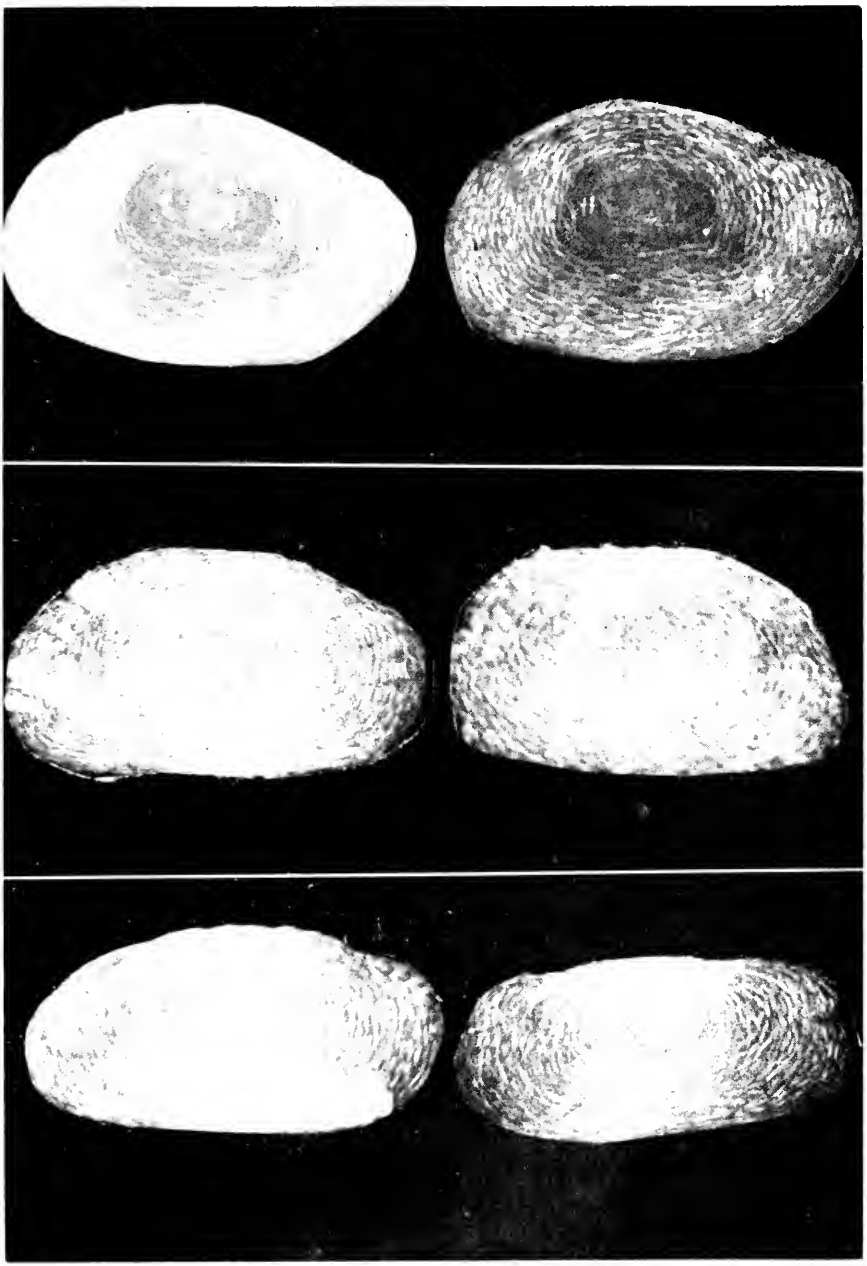

Fig. 74. *Caecilia subterminalis* Taylor. Scales from type, EHT-HMS no. 1732, from "Ecuador." From last 3 cm preceding vent. Scale at upper right about 1.1 ×, 1.7 mm.

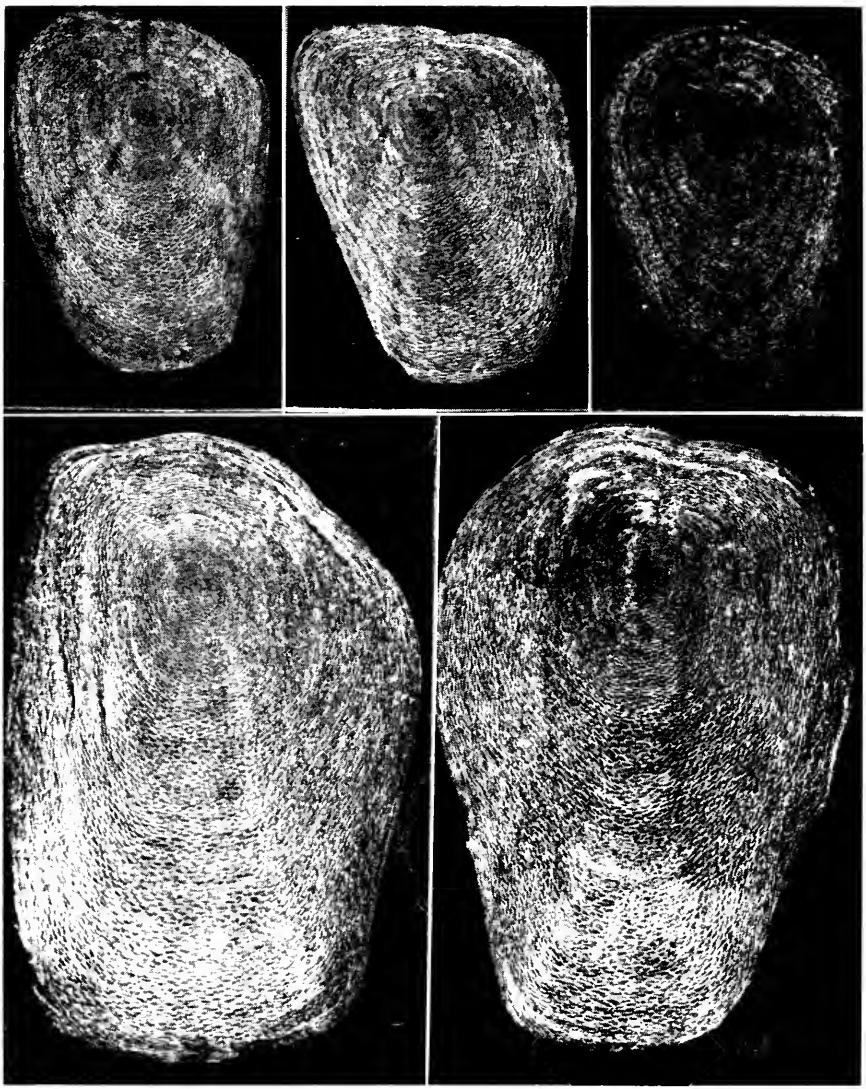

FIG. 75. *Caecilia tentaculata* (Linnaeus). Scales from AMNH no. 49961, Río Copataza, Ecuador. Upper three from 4 cm from end. Lower right scale 3.2 × 4.4 mm.

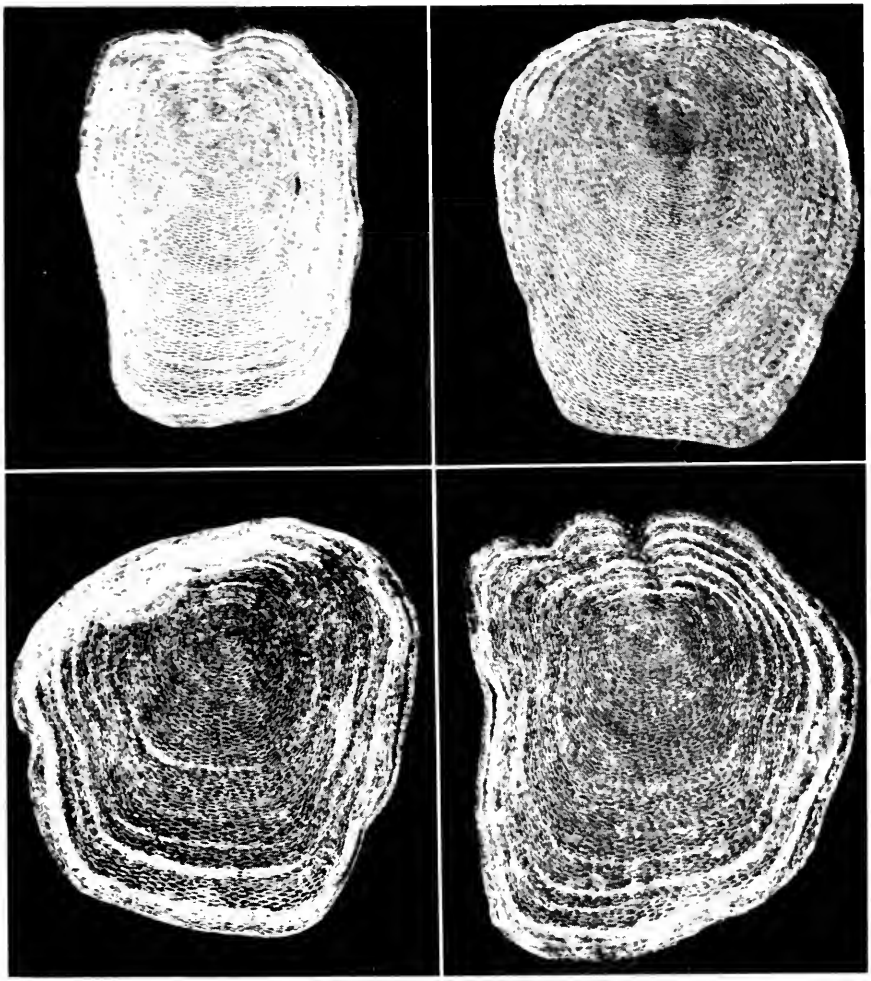

Fig. 76. *Caecilia thompsoni* Boulenger. Scales from BMNH no. 1092.5.15.26 (1946.9.5.13), Villeta, Río Coquetá, Colombia, 3500 ft. elev. Largest scale (lower right), 2.0 × 2.6 mm.

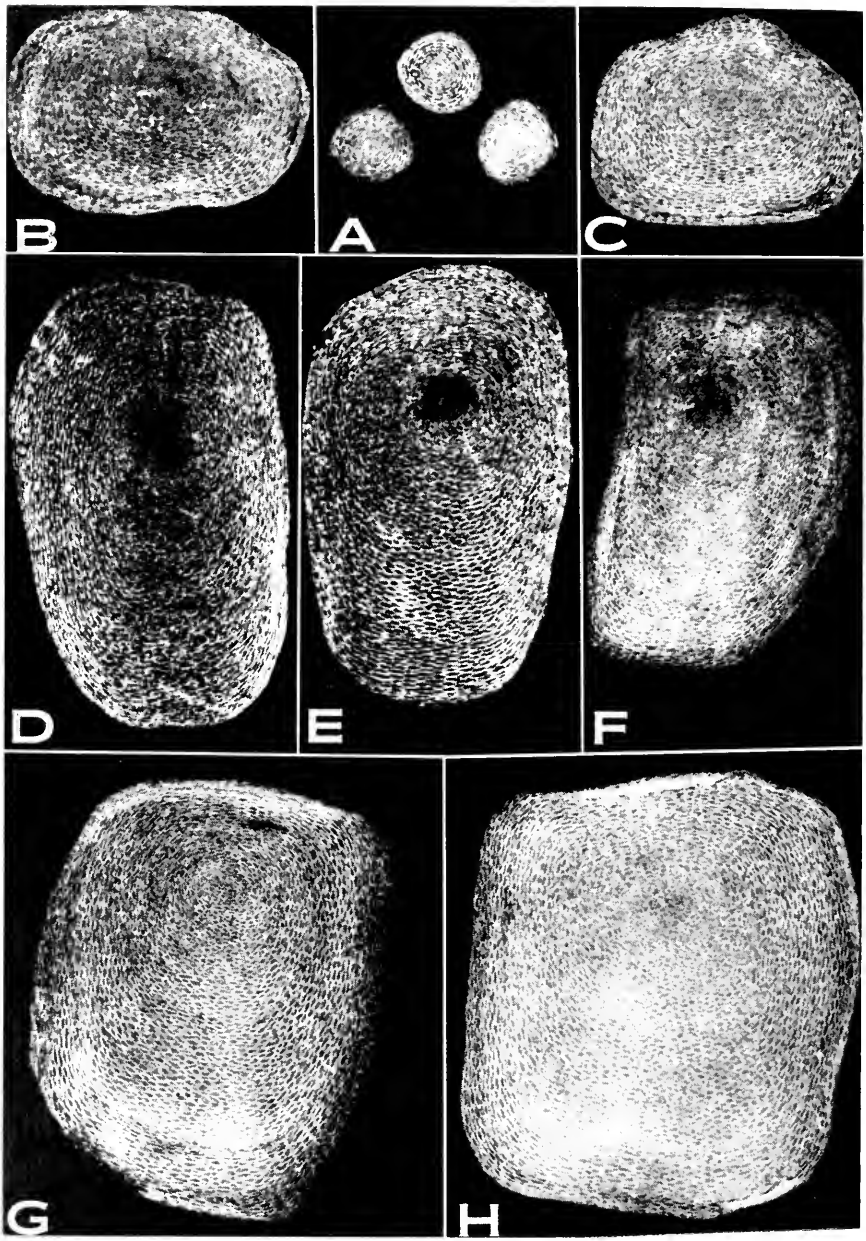

FIG. 77. *Caecilia volcani* Taylor. Scales from type, EHT-HMS no. 46899, El Valle de Antón, Coclé, Panamá, elev. 550 m. A) subdermal scales; B-C) dorsal scales from near middle of body; D-E) from 1 cm anterior to vent. G and H measure 1.9 × 2.1 and 2.0 × 2.15 mm. Subdermals measure about 0.17 to 0.25 mm in largest dimension.

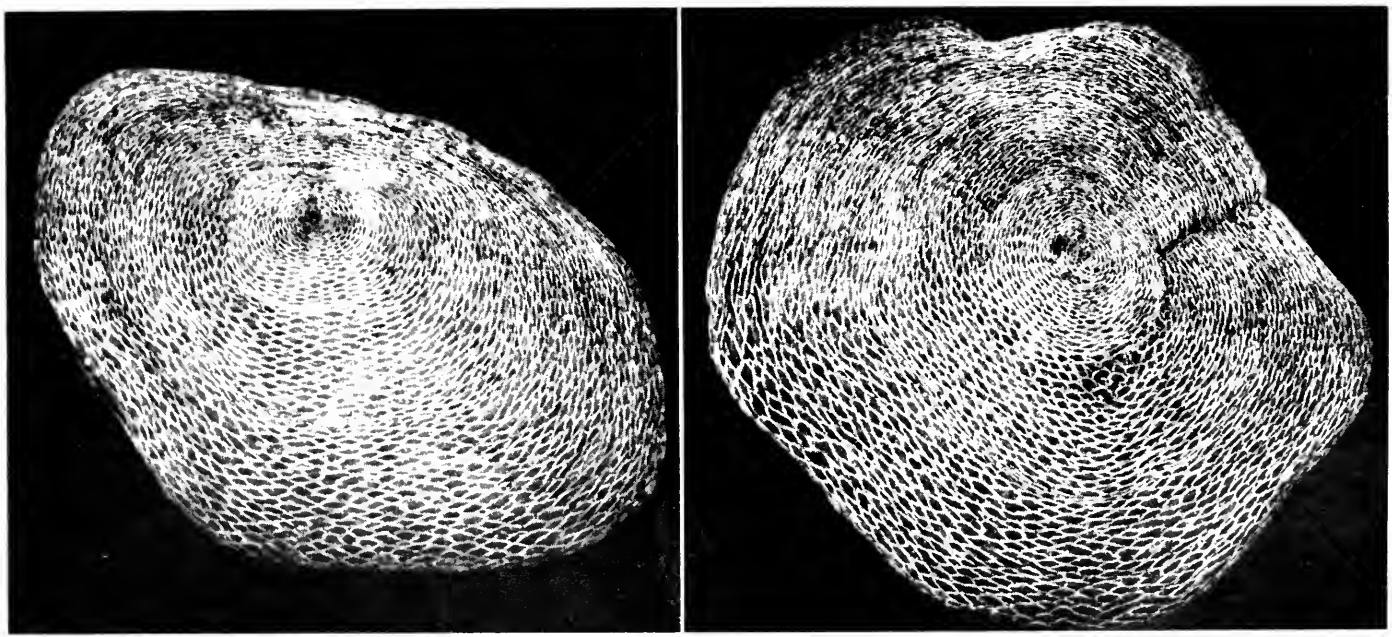

FIG. 78. *Oscaecilia bassleri* (Dunn). Scales from EHT-HMS no. 1733, Montalvo, Ecuador. The scales measure 2.1 × 3.1 and 2.5 × 3.1 mm.

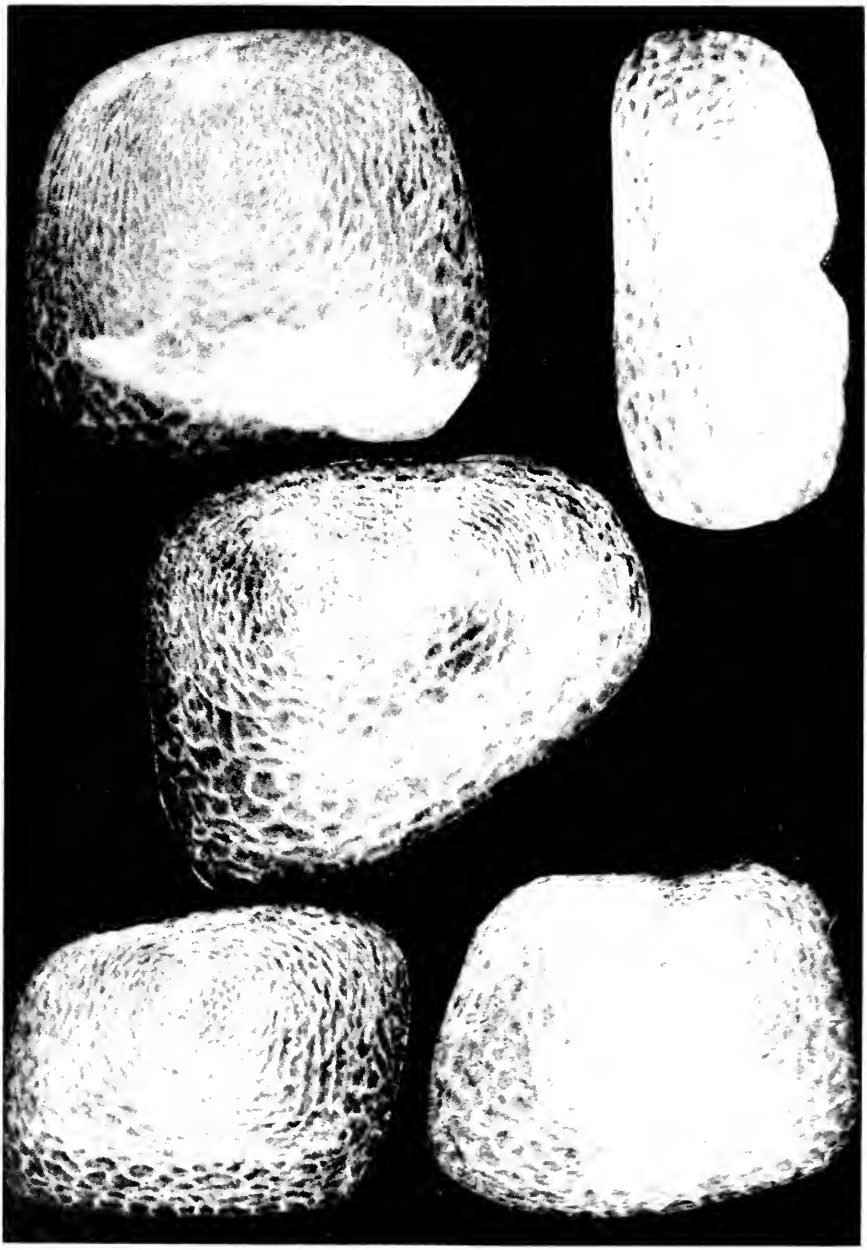

FIG. 79. *Oscaecilia ochrocephala* (Cope). Scales from EHT-HMS no. 1736, Gatun, Canal Zone, Panamá. Size of lower right scale, about 1.2 × 1.6 mm.

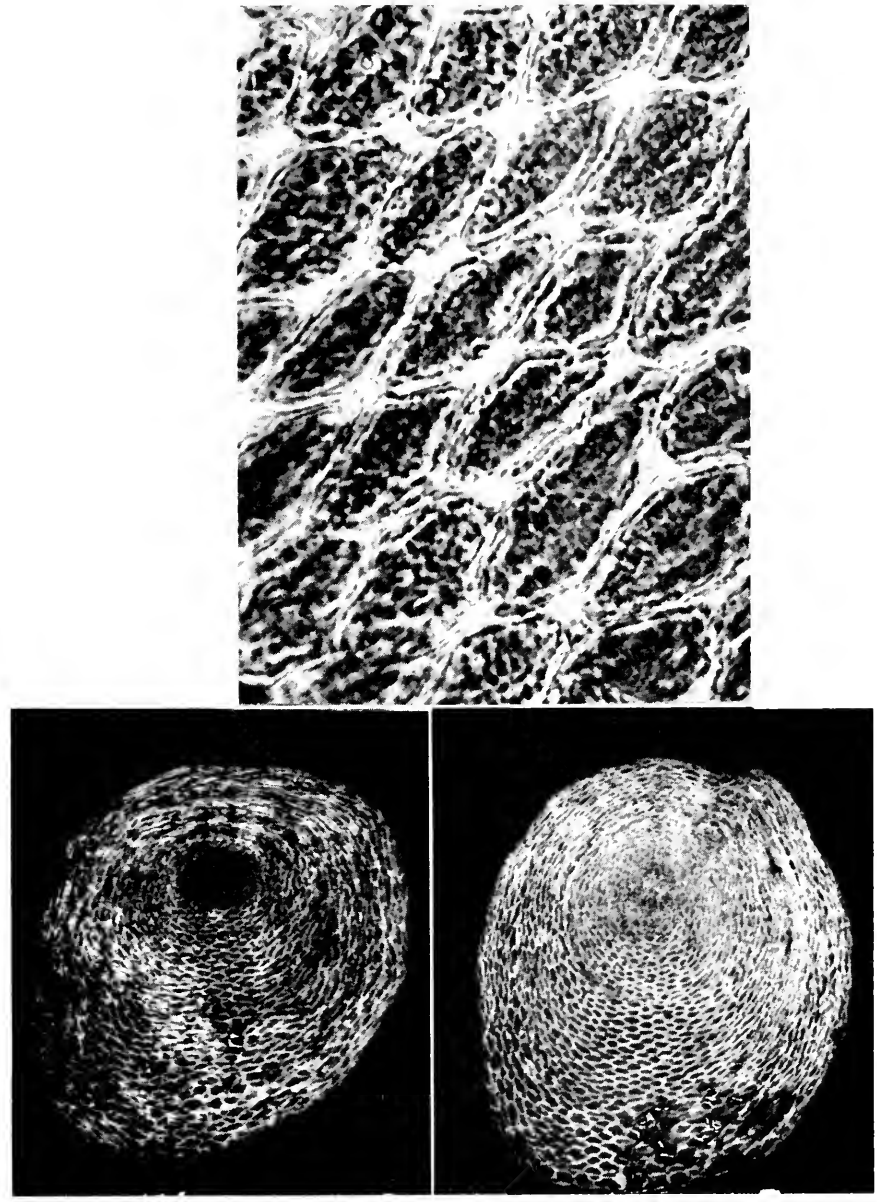

FIG. 80. *Oscaecilia polyzona* (Fischer). Scales from lectotype, ZMB no. 9524, Cárceres, Río Magdalena, Antioquia, Colombia. Upper illustration, section of a large scale photographed with a phase-contrast microscope, 900×. Scale on lower right measures 1.5 × 1.7 mm.

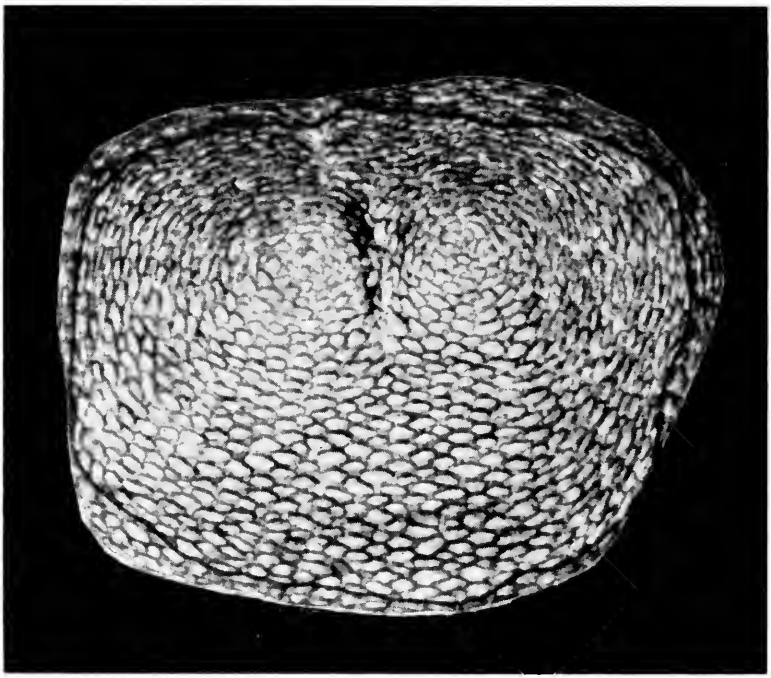

FIG. 81. *Oscaecilia zweifeli* Taylor. Scale from type, AMNH no. 20079, from a creek tributary to the Río Mazaruni, Guyana. This figure is a "positive," the squamulae appearing white. Scale approximately 1.2 × 1.9 mm.

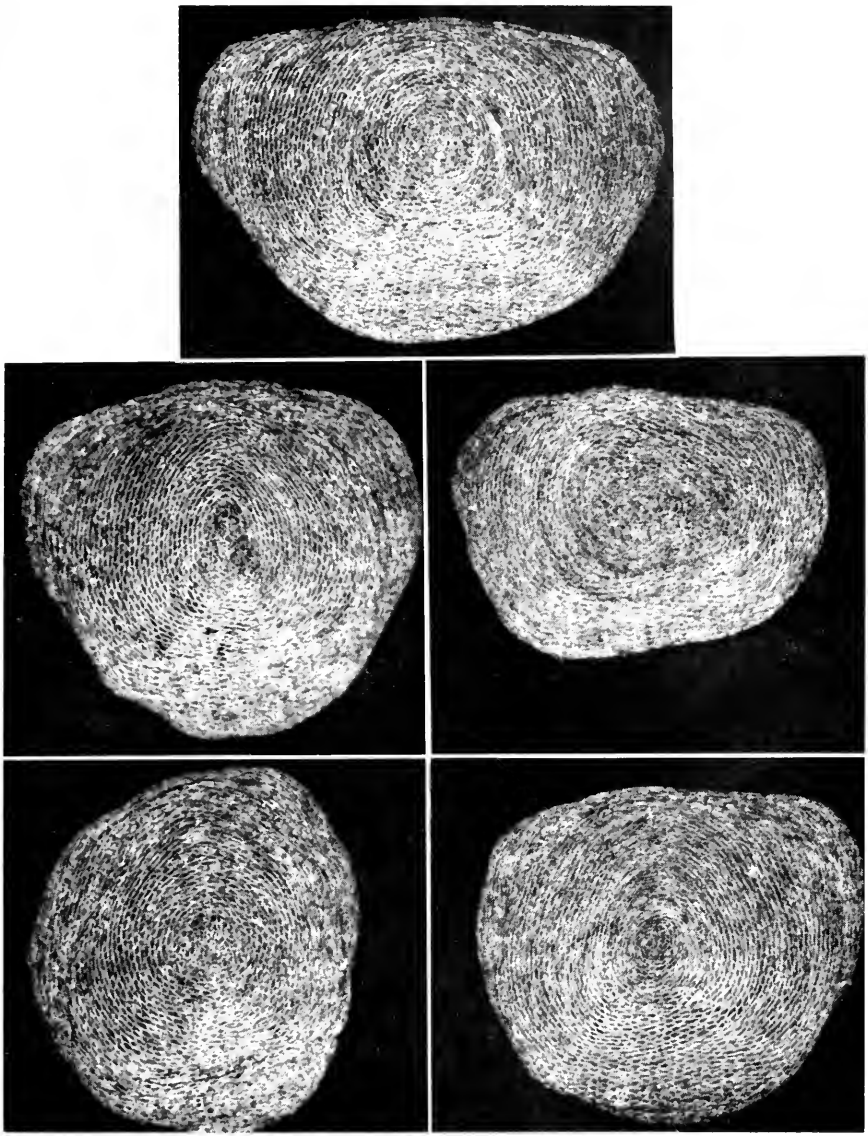

Fig. 82. *Cryptopsophis simus* (Cope). Scales from the type of *C. multiplicatus* Boulenger, USNM no. 29765, Costa Rica. The largest scale measures 3.2 × 4.5 mm.

FIG. 83. *Brasilotyphlops braziliensis* (Dunn). Scales from type, AMNH no. 51751, Manaos, Brasil. These three small scales failed to produce better results in three attempts for pictures.

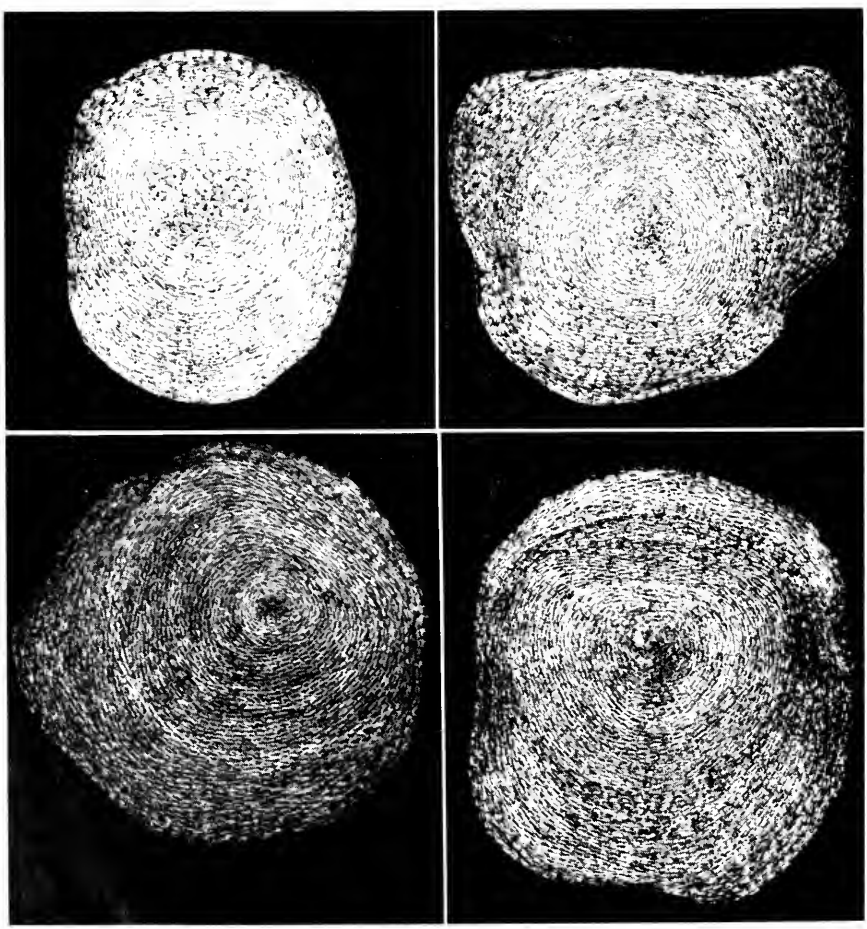

FIG. 84. *Dermophis balboai* Taylor. Scales from KUMNH no. 108935, from Chiriquí, Finca Santa Clara, Panamá. Largest scale about 1.8 × 2.07 mm.

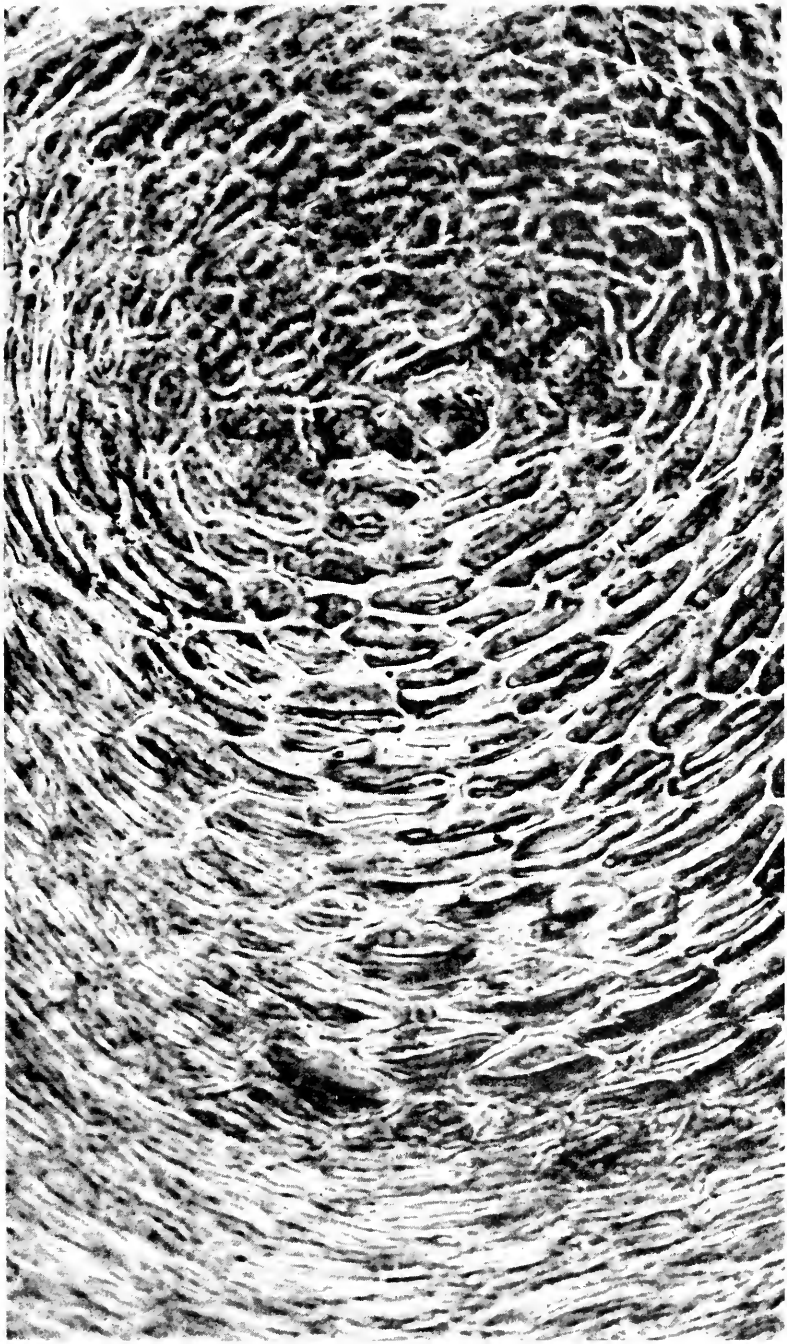

Fig. 85. *Dermophis balboai* Taylor. Scale from KUMNH no. 108935, from Chiriquí, Finca Santa Clara, Panamá. Photomicrograph taken with a phase-contrast microscope, 900×.

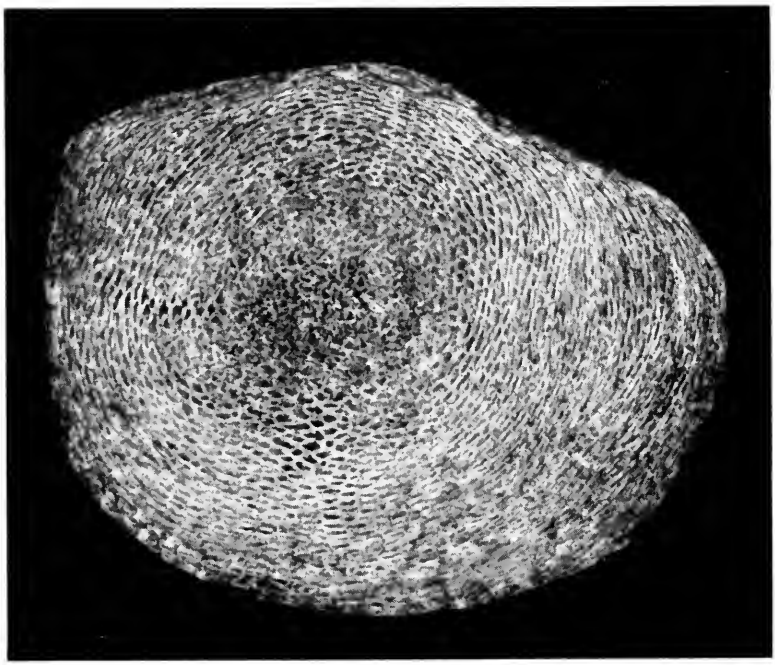

FIG. 86. *Dermophis costaricense* Taylor. Scale from topotype, KUMNH no. 36337, Isla Bonita (Cinchona), slope of Poaś Volcano, Costa Rica. Measures 1.6 × 1.9 mm.

FIG. 87. *Dermophis glandulosus* Taylor. Scales from Univ. Cal. (Berkeley) Coll. no. 80922, from between San Isidro del General and Dominical, Puentarenas Prov., Costa Rica. Three upper scales from 3rd cm preceding vent. Measurement of lower scales approximately 1.8 × 1.8 mm.

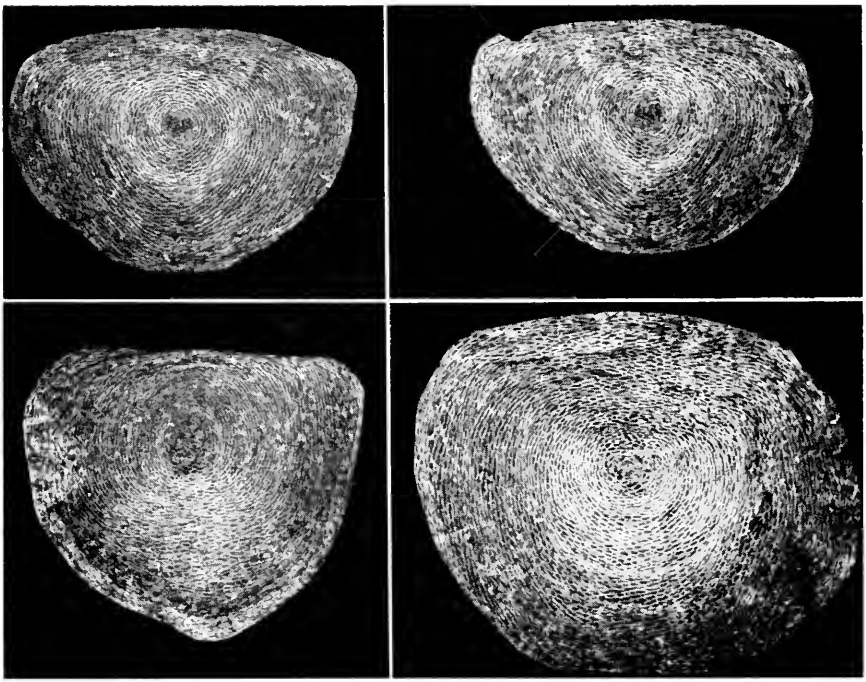

FIG. 88. *Dermophis gracilior* (Günther). Scales from BMNH no. 1946.9.5.33, Chiriquí, Panamá. Largest scale 2.4 × 2.8 mm.

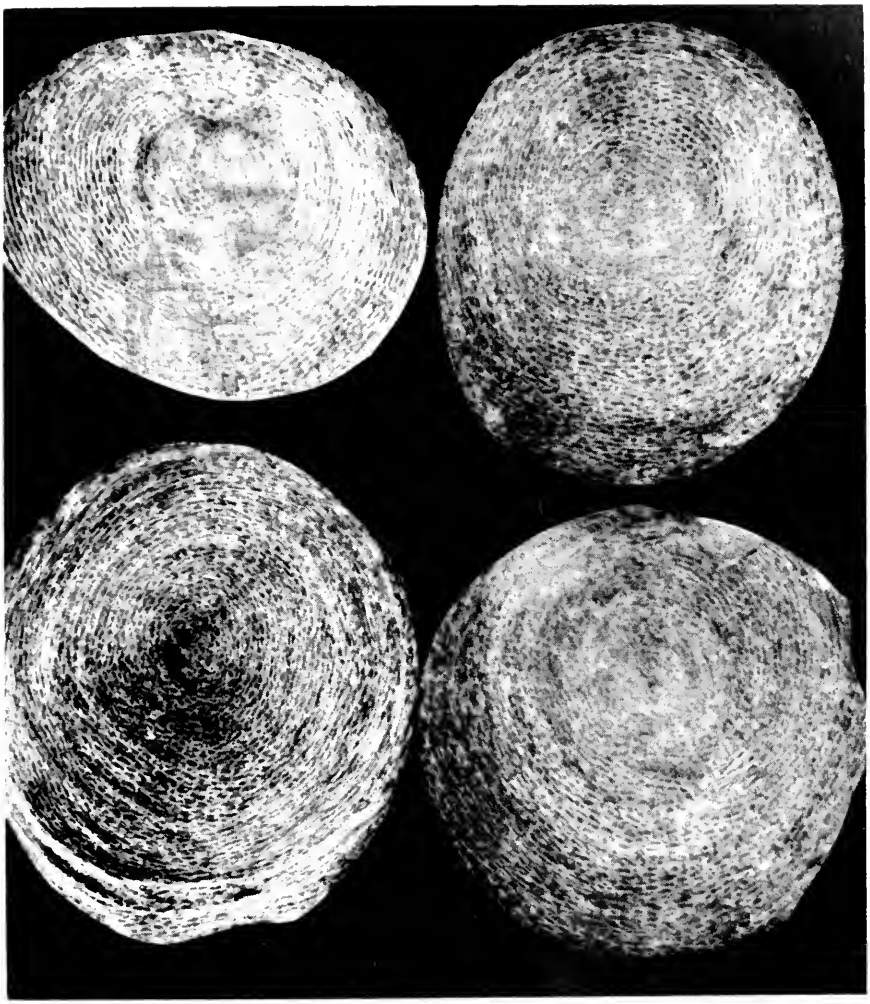

Fig. 89. *Dermophis mexicanus mexicanus* (Duméril and Bibron). Scales from EHT-HMS no. 1793 (28412), Tuxtla Guterriez, Chiapas, Mexico. Largest scales about 2.9 × 3.0 mm.

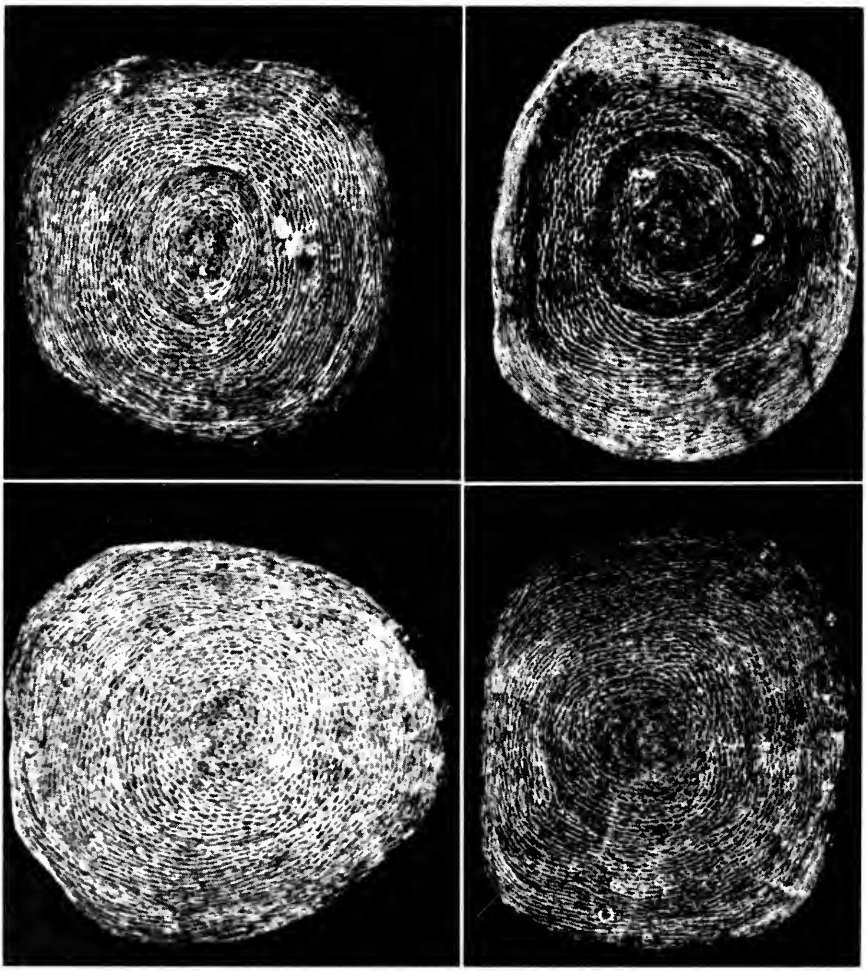

FIG. 90. *Dermophis mexicanus clarkii* (Barbour). Scales from type, MCZ no. 11047, Tela, Honduras. Largest, lower left, measures 2.5 × 2.8 mm.

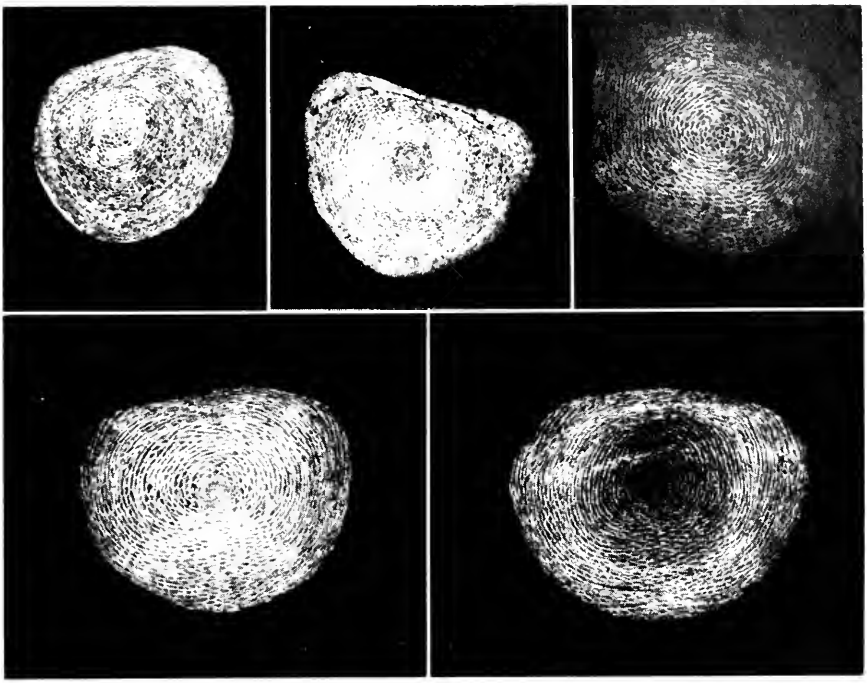

FIG. 91. *Dermophis oaxacae* (Mertens). Scales from USNM no. 115058, Xaltianguis, Guerrero, Mexico. Two smallest scales from 4th cm preceding vent. Lower right scale, 1.4 × 1.7 mm.

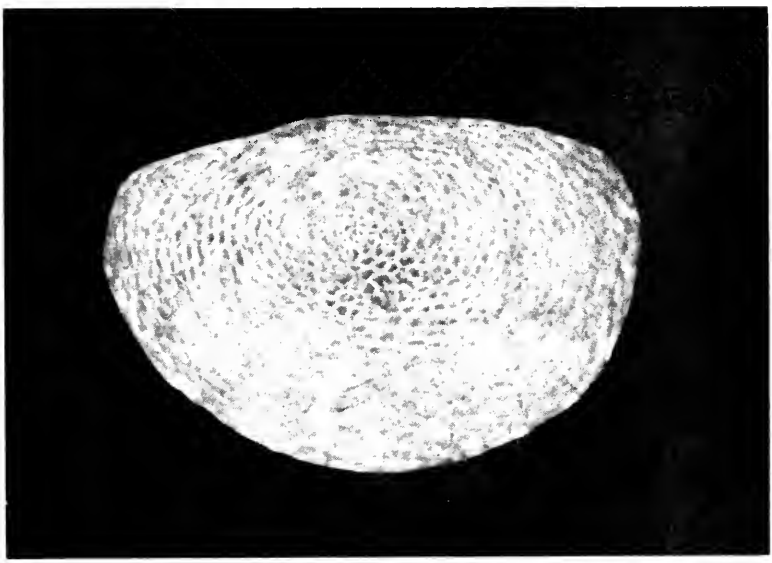

FIG. 92. *Dermophis occidentalis* Taylor. Scale from type, KUMNH no. 36208, Dominical Road, about 15 km WNW of San Isidro del General, San José Prov., Costa Rica. Size about 0.9 × 1.4 mm.

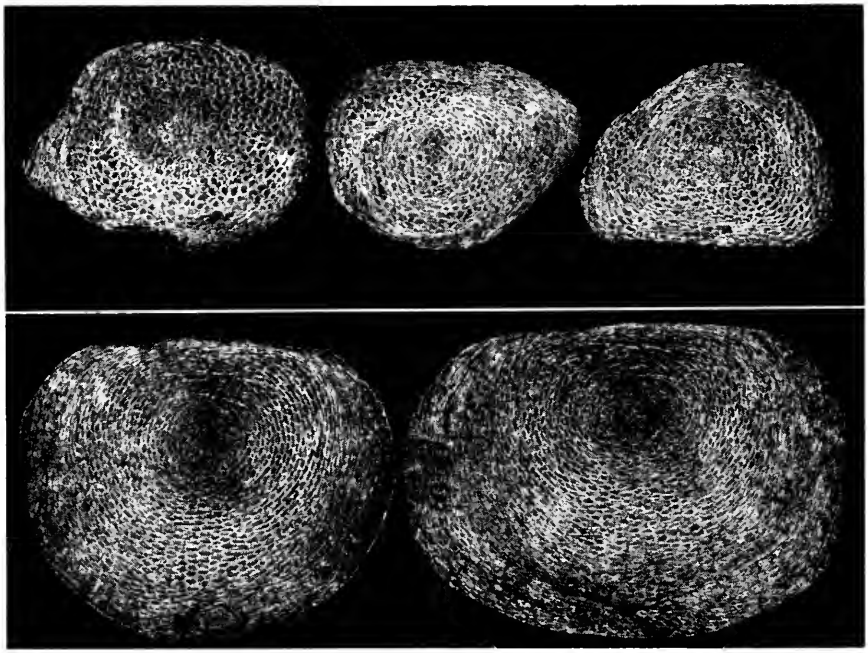

FIG. 93. *Dermophis parviceps* (Dunn). Scales from KUMNH no. 36276, Moravia de Chirripo, Cartago Prov., Costa Rica. Three upper scales from 4 cm preceding vent. Largest scale (lower right), 1.15 × 1.7 mm.

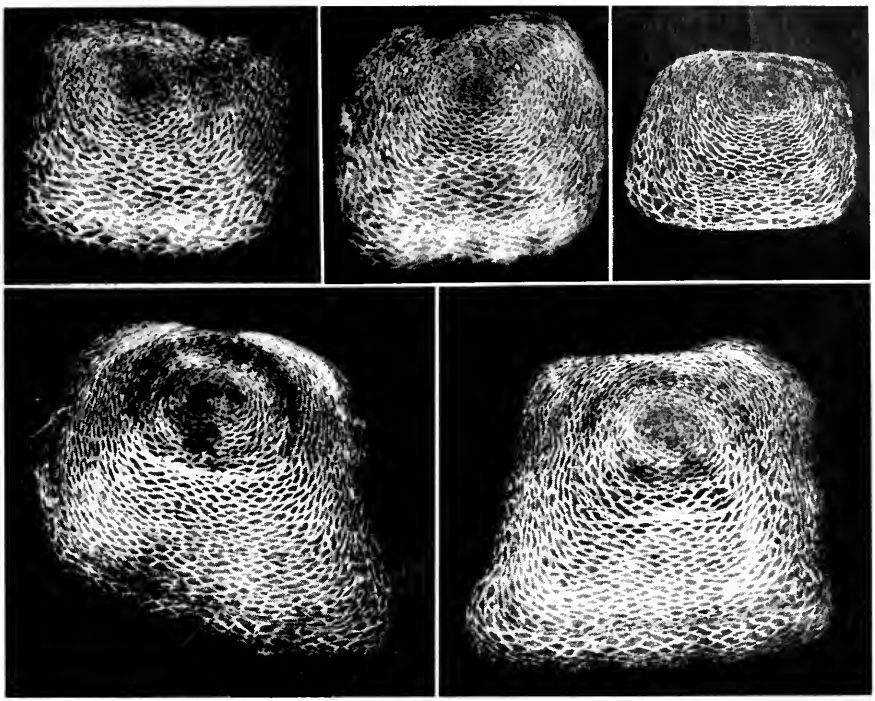

FIG. 94. *Gymnopis multiplicata multiplicata* Peters. Scales from USNM no. 70655, Hda. San Bosco, Tilarán, Guanacaste, Costa Rica. Largest scale (lower left), 1.8 × 2.2 mm.

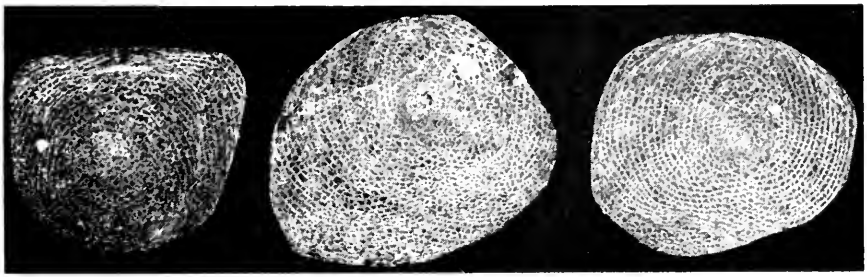

FIG. 95. *Gymnopis multiplicata oligozona* (Cope). Scales from type, USNM no. 25187, type-locality unknown. Largest scale (median), 1.2 × 1.75 mm.

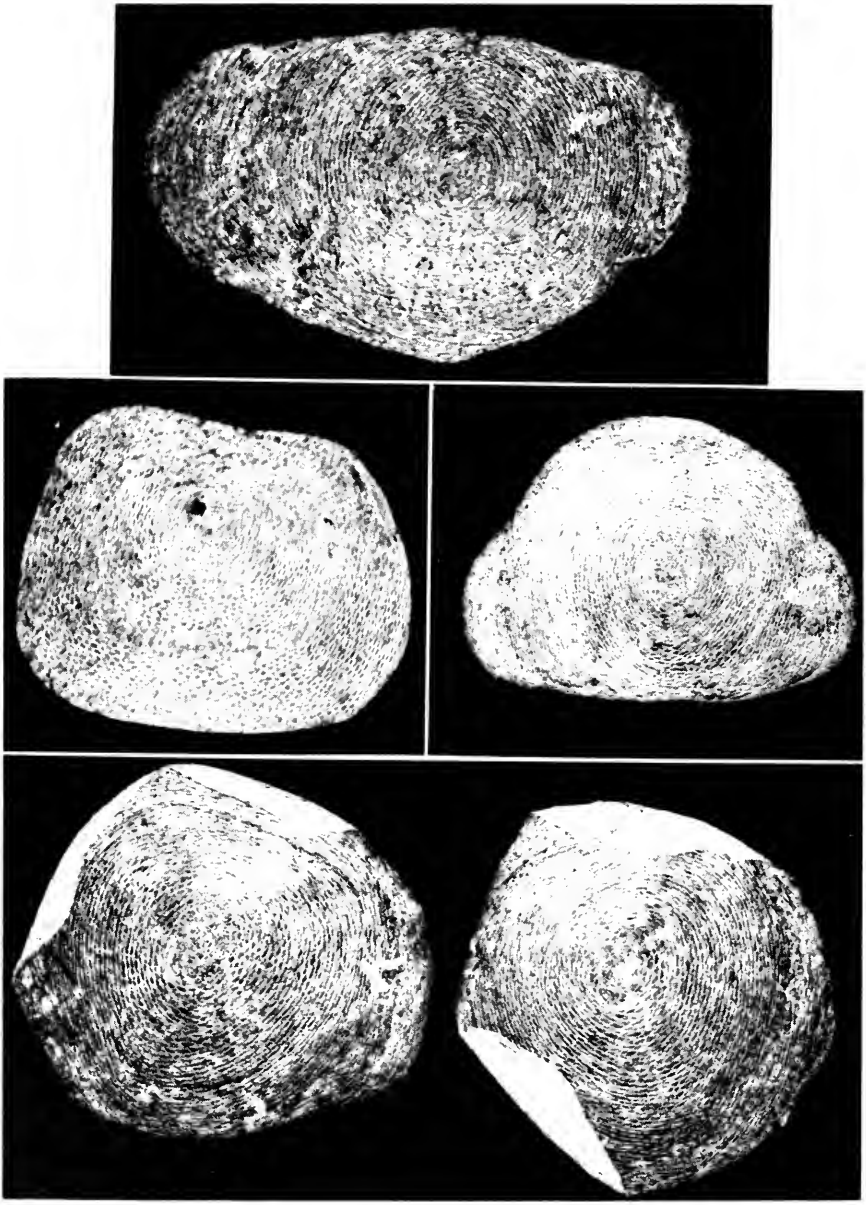

FIG. 96. *Gymnopis multiplicata proxima* (Cope). Three upper scales from type (lectotype), USNM no. 29763, from near coast at Limón, Costa Rica. Largest, 1.6 × 2.7 mm. Two lower scales from cotype, 29762 ♀ (presumably topotype). Larger, 2.0 × 2.1 mm.

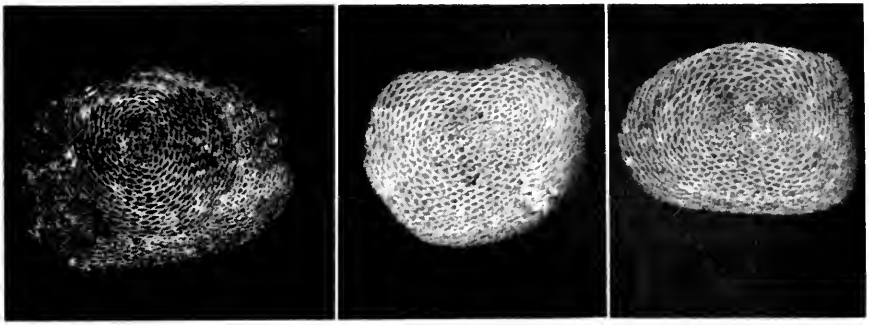

FIG. 97. *Microcaecilia albiceps* (Boulenger). Scales from type, BMNH no. 80.12.5.14 (1946.9.5.3), Napa, Ecuador. Largest scale, 0.91 × 1.4 mm.

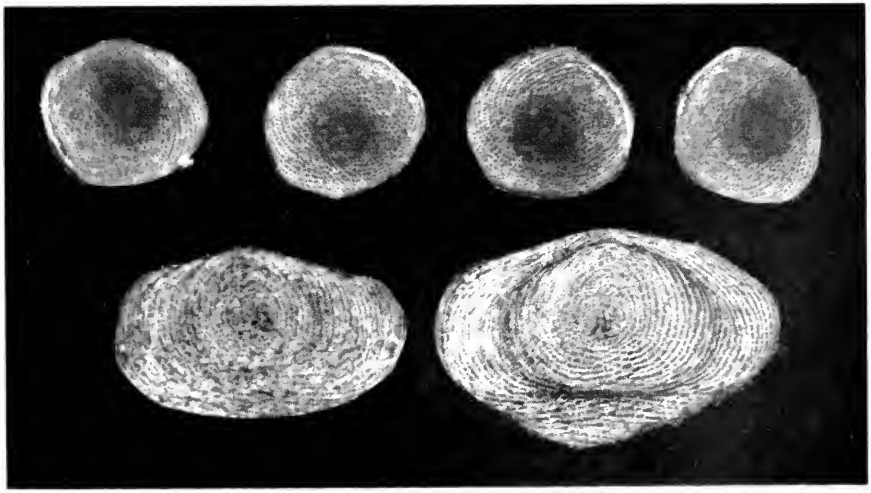

FIG. 98. *Microcaecilia rabei* (Roze and Solano). Scales from type, UCVMB no. 5126, from Cerro Lema, Río Chicanán, Bolívar, Venezuela. Four upper scales from 3rd cm preceding vent, about 0.4 × 0.5 mm. Larger of lower scales, 0.8 × 1.3 mm.

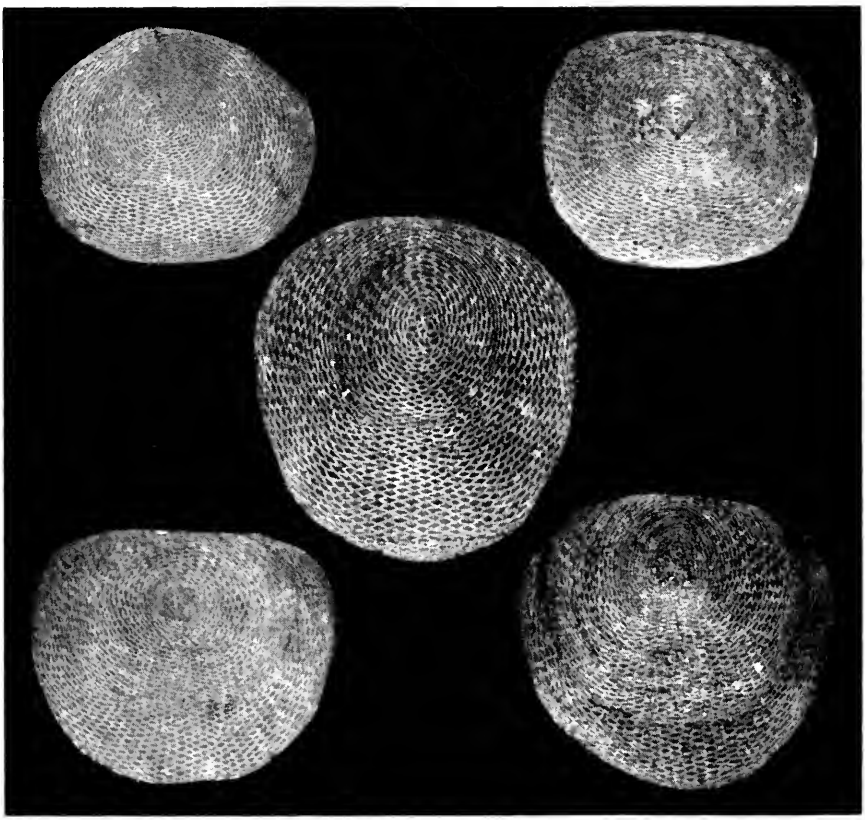

FIG. 99. *Microcaecilia supernumeraria* Taylor. Scales from type, ZMB no. 5268, "São Paulo," Brasil. Largest scale, 1.0 × 1.35 mm.

FIG. 100. *Microcaecilia supernumeraria* Taylor. From type, ZMB no. 5268, from "São Paulo," Brasil. A) Section of body near middle. B) Section of body posterior to middle. C) Section of body in last fifth. Scale rows visible externally, especially in C. D) Section of connective tissue showing the subdermal scales *in situ*.

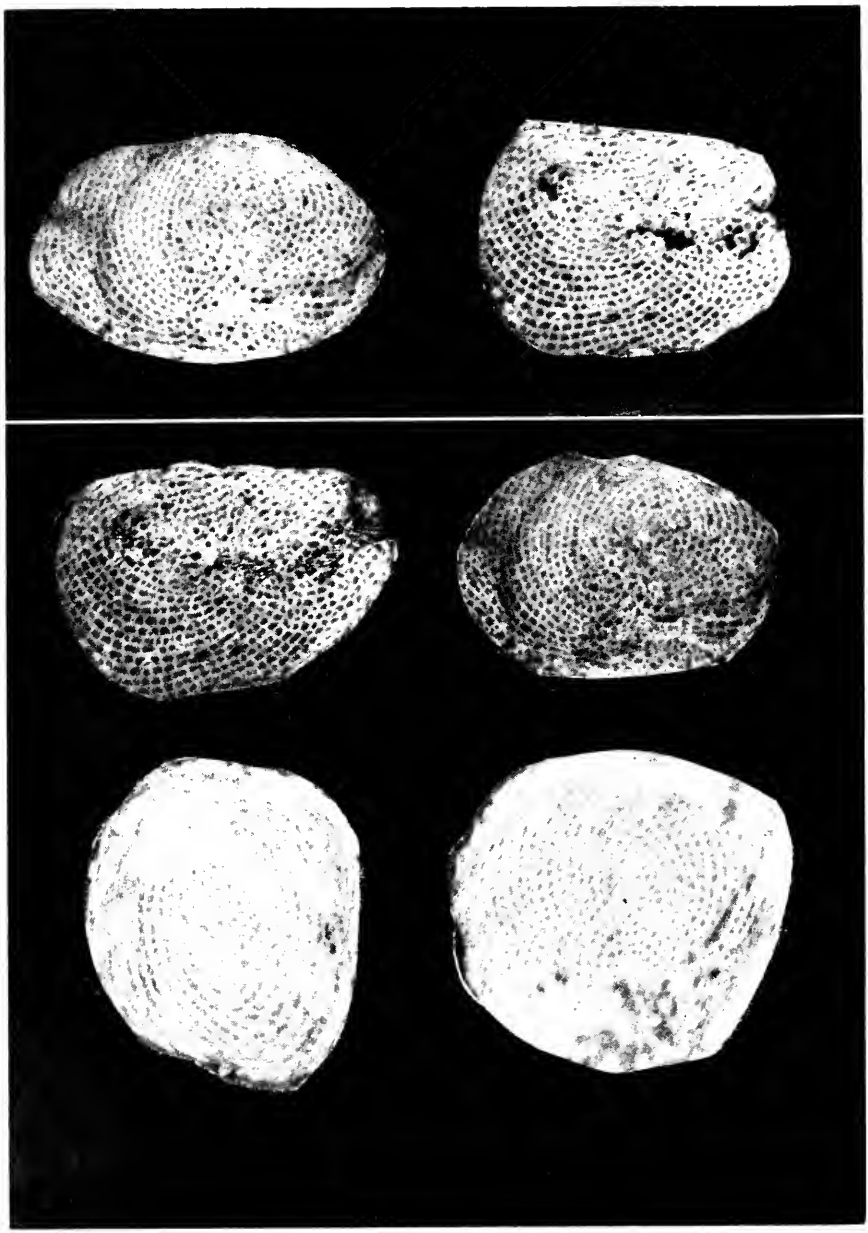

FIG. 101. *Microcaecilia unicolor* (A. Duméril). Scales of ZMB no. 9600, Cayenne, French Guiana. The two upper scales measure 0.63 × 1.1 and 0.64 × 1.05 mm.

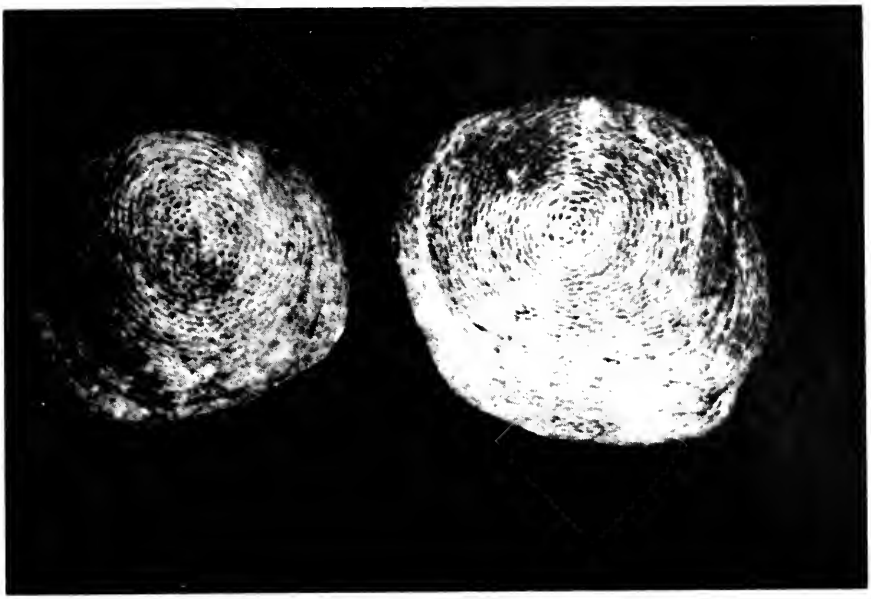

FIG. 102. *Parvicaecilia nicefori* (Barbour). Scales from AMNH no. 23387, from Honda, Tolima, Colombia (Magdalena Valley, Caribbean drainage). Larger scale, 0.9 × 1.3 mm.

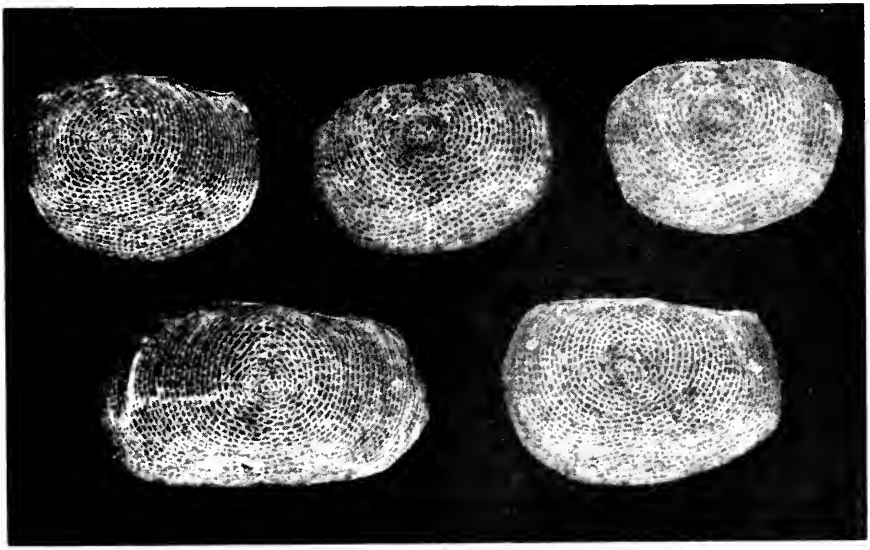

FIG. 103. *Parvicaecilia pricei* (Dunn). Scales from paratype, AMNH no. 1335, "South America." Lower right scale, 0.6 × 0.85 mm.

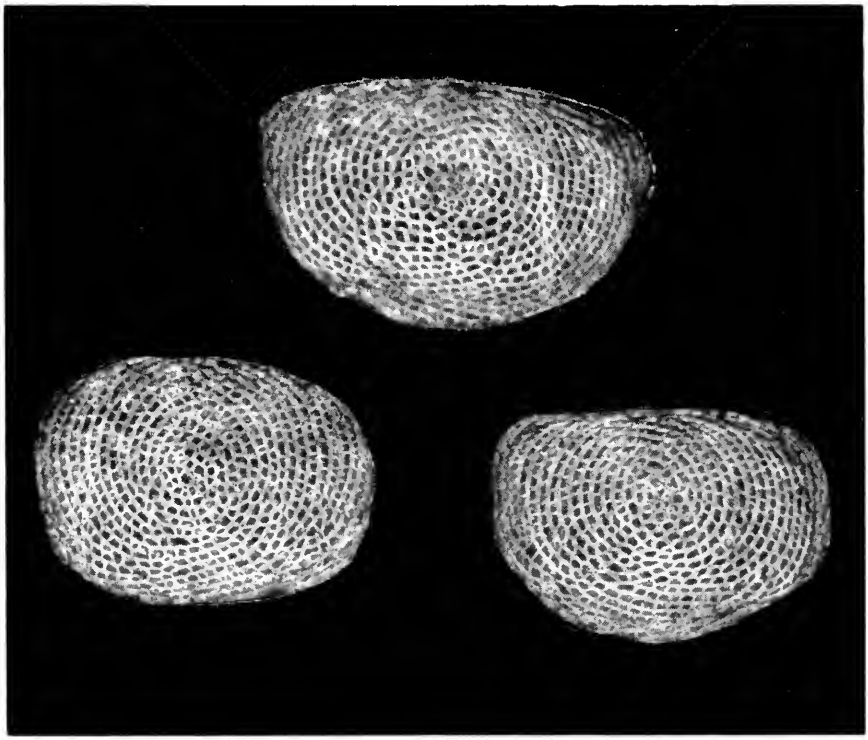

FIG. 104. *Idiocranium russeli* Parker. Scales from paratype, EHT-HMS no. 4687, Makamunu Assumbo, Mamfe Division, Cameroons, Africa.

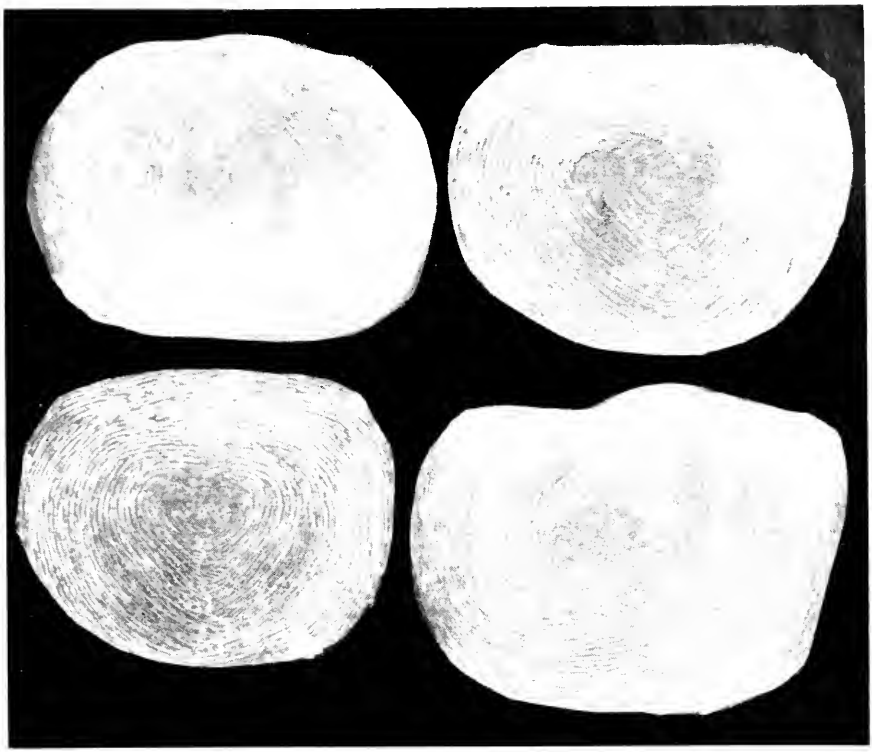

FIG. 105. *Schistometopum ephale* Taylor. Scales from paratype, BMNH no. 1927.2.10-1, São Thomé Island, Gulf of Guinea. Largest scale about 1.1 × 1.3 mm.

FIG. 106. *Schistometopum thomense* (Barboza du Bocage). Scales from AMNH no. 23461, São Thomé Island, Gulf of Guinea. Larger scale, 1.0 × 1.25 mm.

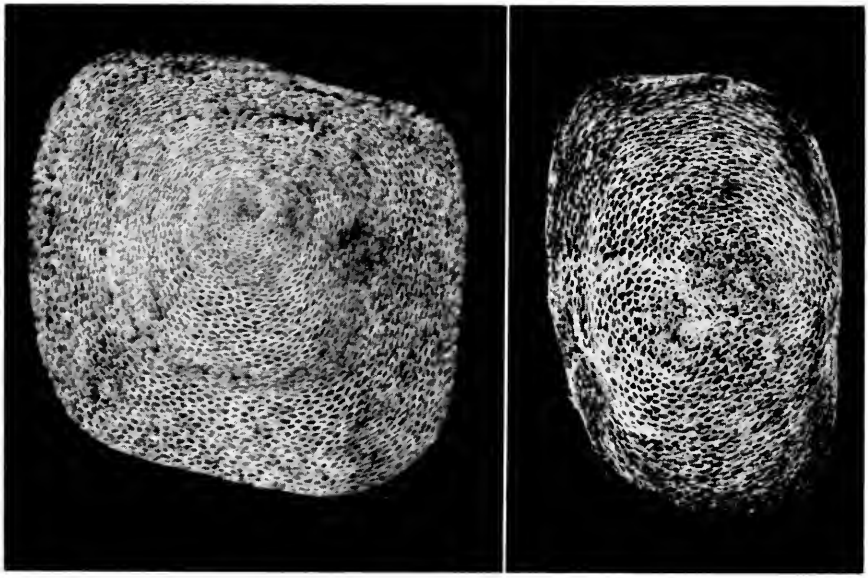

FIG. 107. *Herpele squalostoma* (Stutchbury). Scales from BMNH no. 1951.10.28.80, "Gaboon," Africa. Larger scale, 1.7 × 1.9 mm. (The scale at right is mounted, rotated 90° inadvertently.)

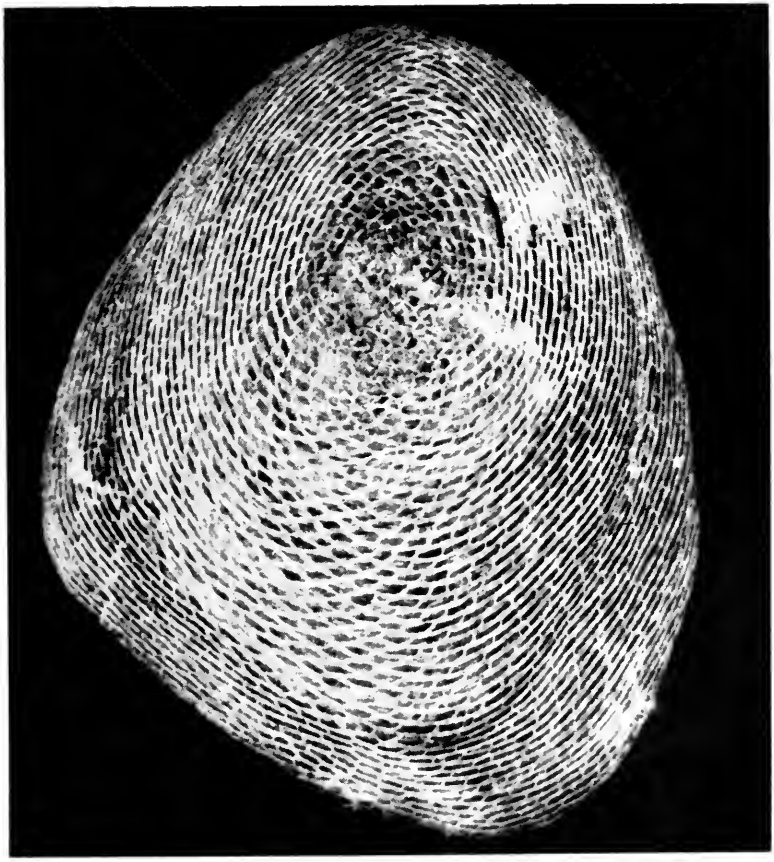

FIG. 108. *Uraeotyphlus malabaricus* (Beddome). Scale from BMNH no. 1874.4.29.181 (1946.9.5.16), from Malabar, India. Size, 1.5 × 1.8 mm.

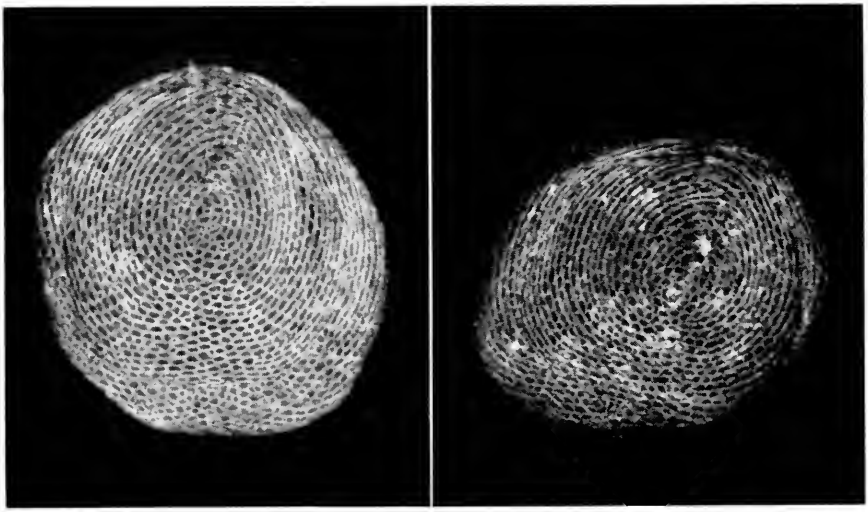

FIG. 109. *Uracotyphlus menoni* Annandale. Scales from MCZ no. 17990, Kotteyam, Trivandrum, India. Larger, 1.4 × 1.45 mm.

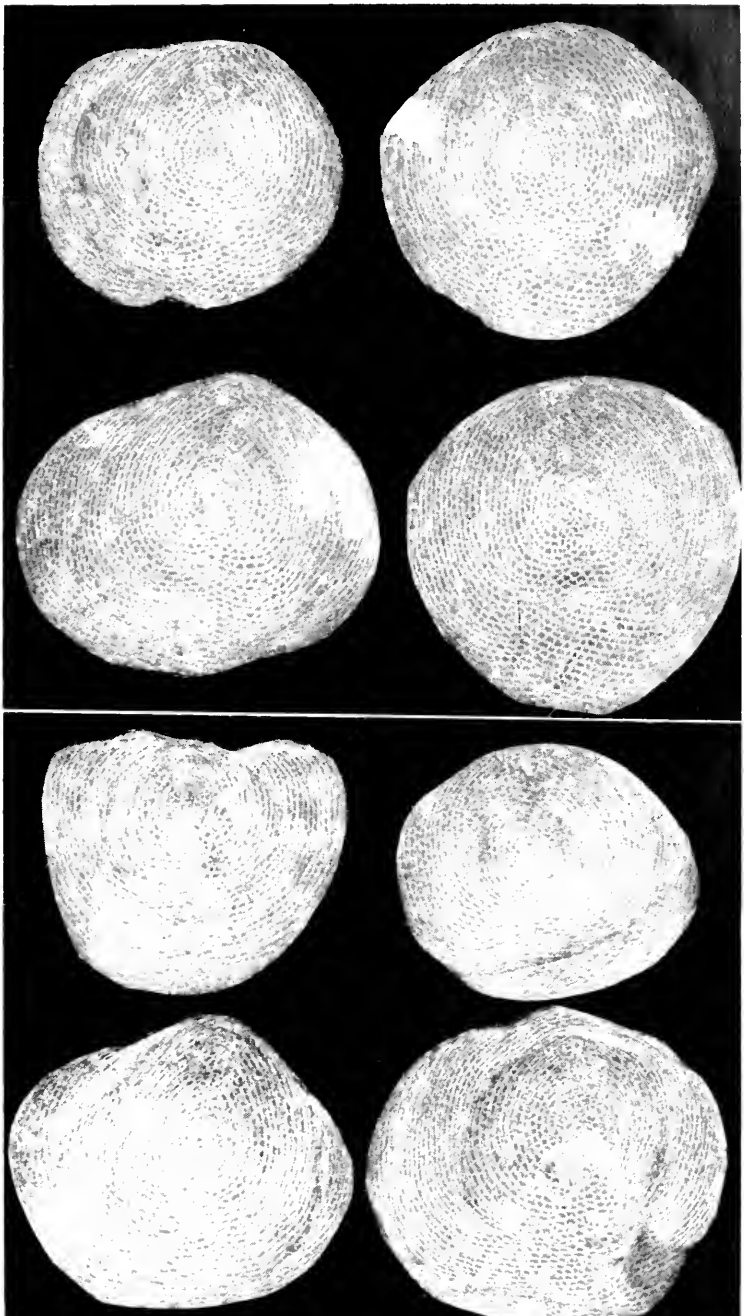

FIG. 110. *Uraeotyphlus narayani* Seshechar. Scales from KUMNH no. 137864, "southern India." Largest scale (lower right) about 1.78 × 1.85 mm.

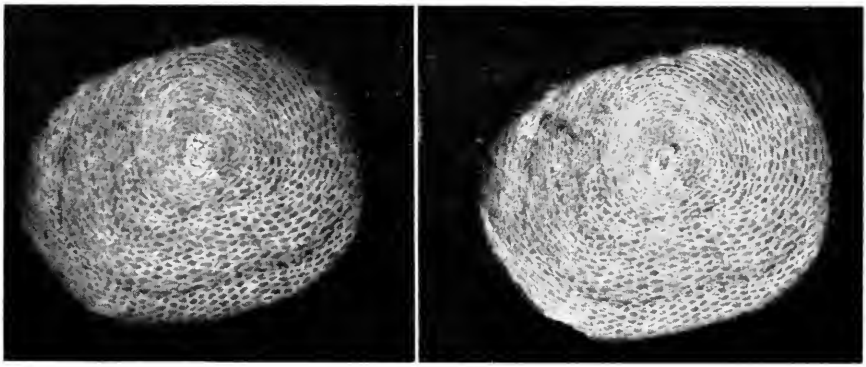

FIG. 111. *Uraeotyphlus oxyurus* (Duméril and Bibron). Scales from AMNH no. 23497, Wynaad, India. Larger scale (right) 1.4 × 1.55 mm.

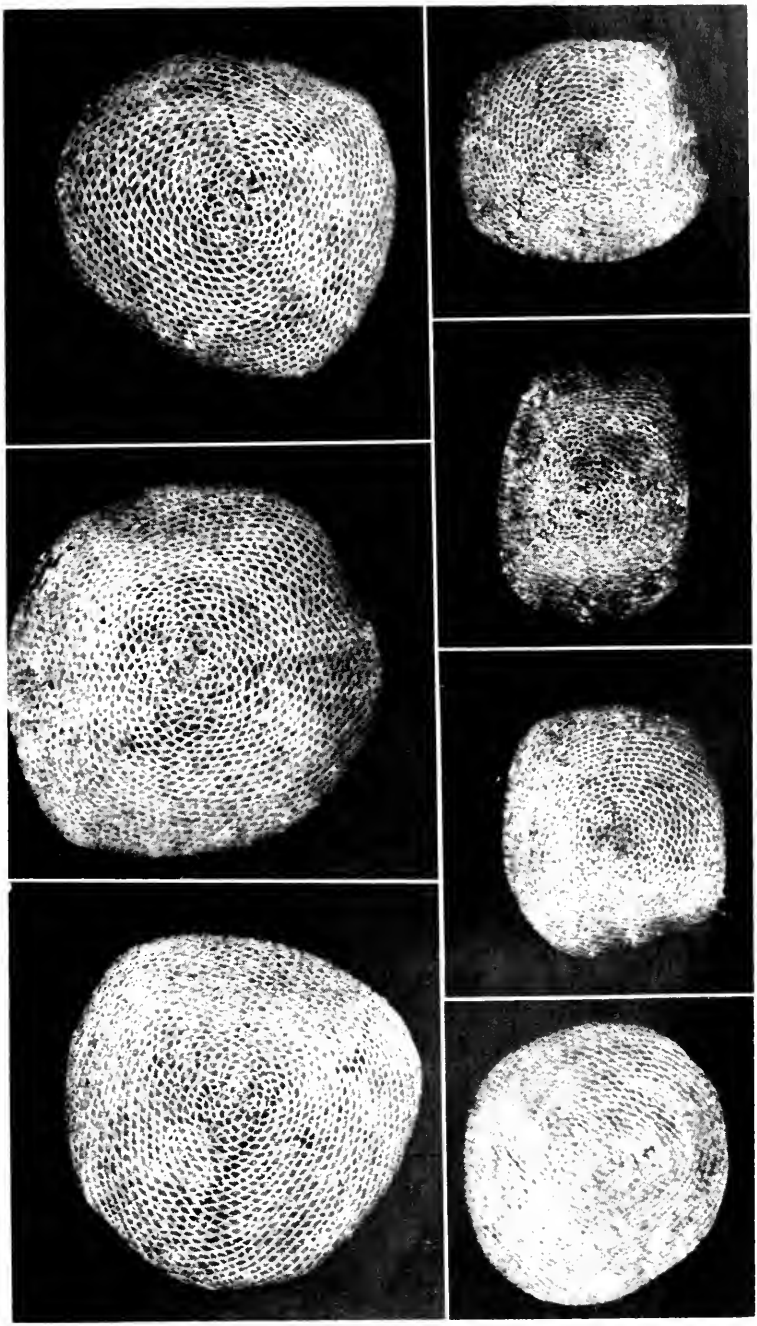

FIG. 112. *Geotrypetes angeli* Parker. Scales from type, BMNH no. 1909.2.2.810 (1946.9.54), Labé, French Guinea. Scales on right from 5th cm from end. Largest (middle left), 1.3 × 1.3 mm.

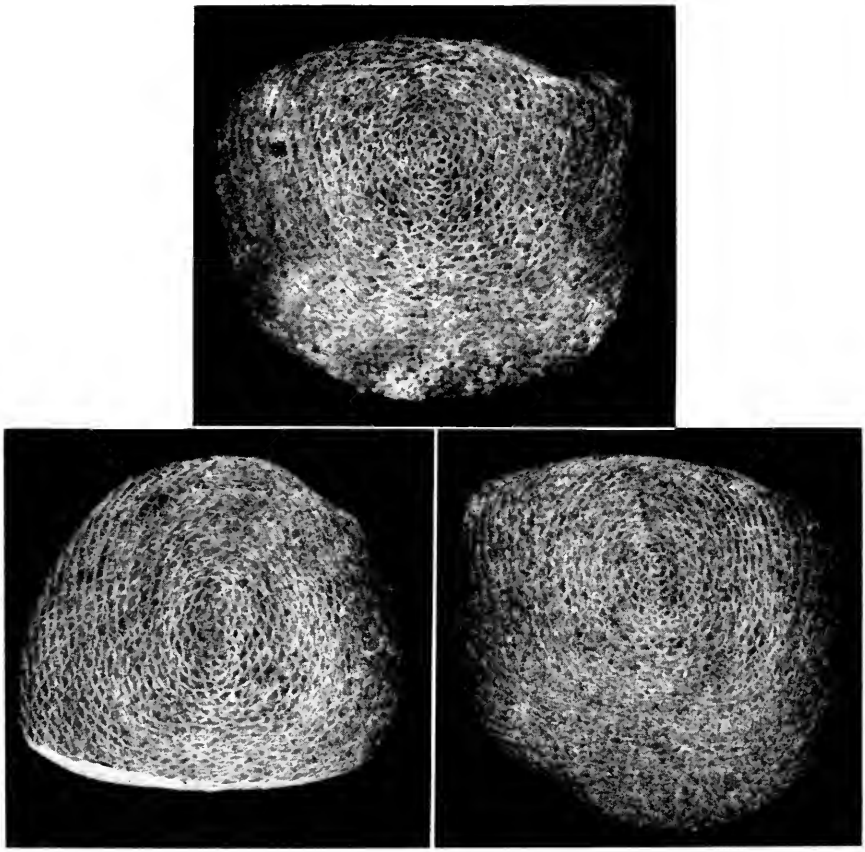

FIG. 113. *Geotrypetes congoensis* Taylor. Scales from paratype, MRAC no. 101415, Kitadi, Mayumbe region, Congo, Africa. Scales seemingly very thin, orange colored. Largest about 1.2 × 1.7 mm.

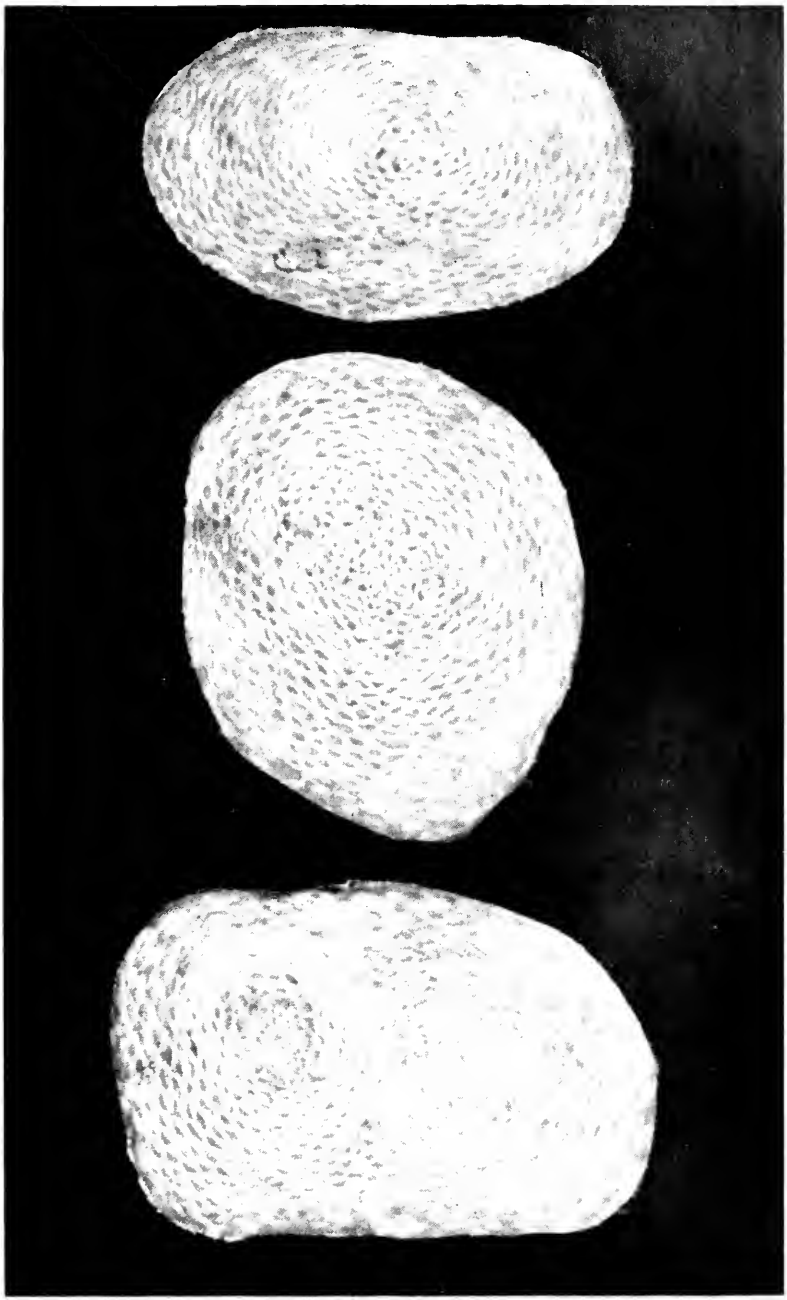

Fig. 114. *Geotrypetes grandisonae* Taylor. Scales from paratype, BMNH no. 1969.976, Ghimbi, Wallega, Ethiopia, 2180 m elev. Largest scale, 1.2 × 1.4 mm.

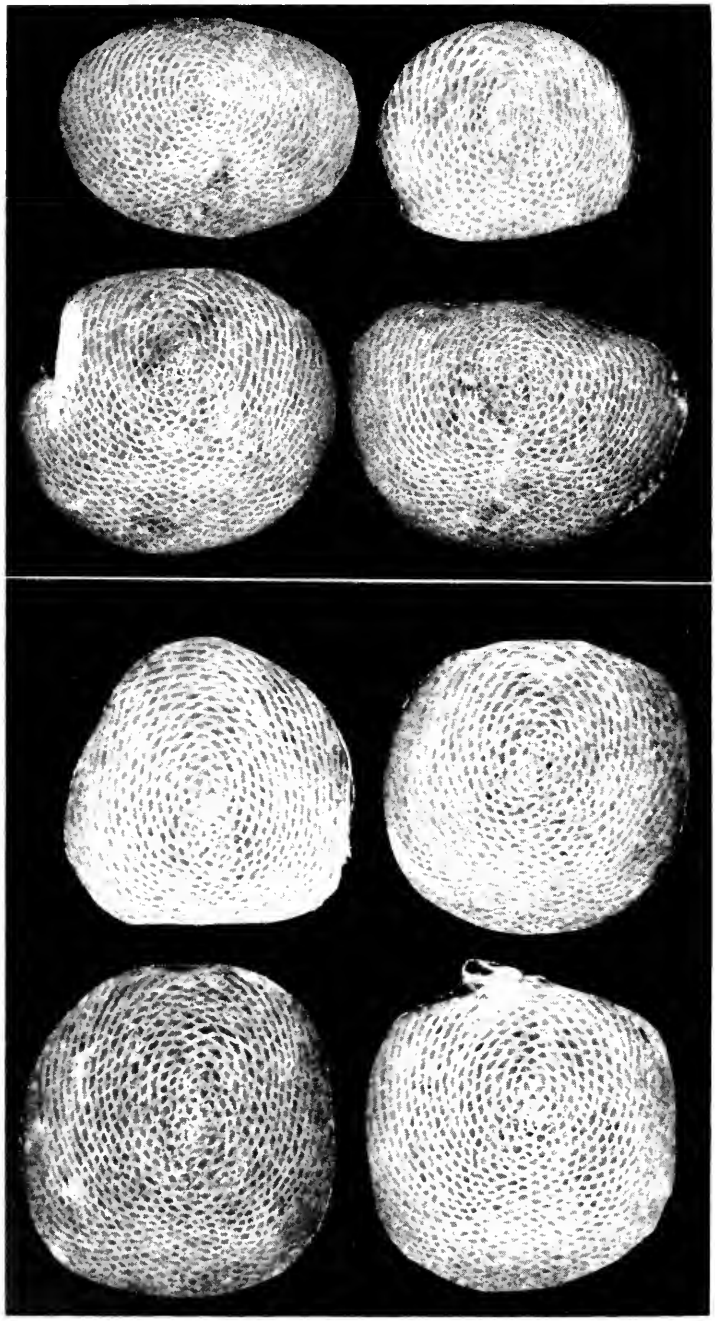

FIG. 115. *Geotrypetes pseudoangeli* Taylor. Four upper scales from type, EHT-HMS no. 4679, Sanoqueleh, Liberia, Africa (near Ganta). Four lower scales, MNHN no. 20-190, Beyla, French Guinea (paratype of *Geotrypetes angeli* Parker). Largest scales almost 2.0 mm in greatest dimension.

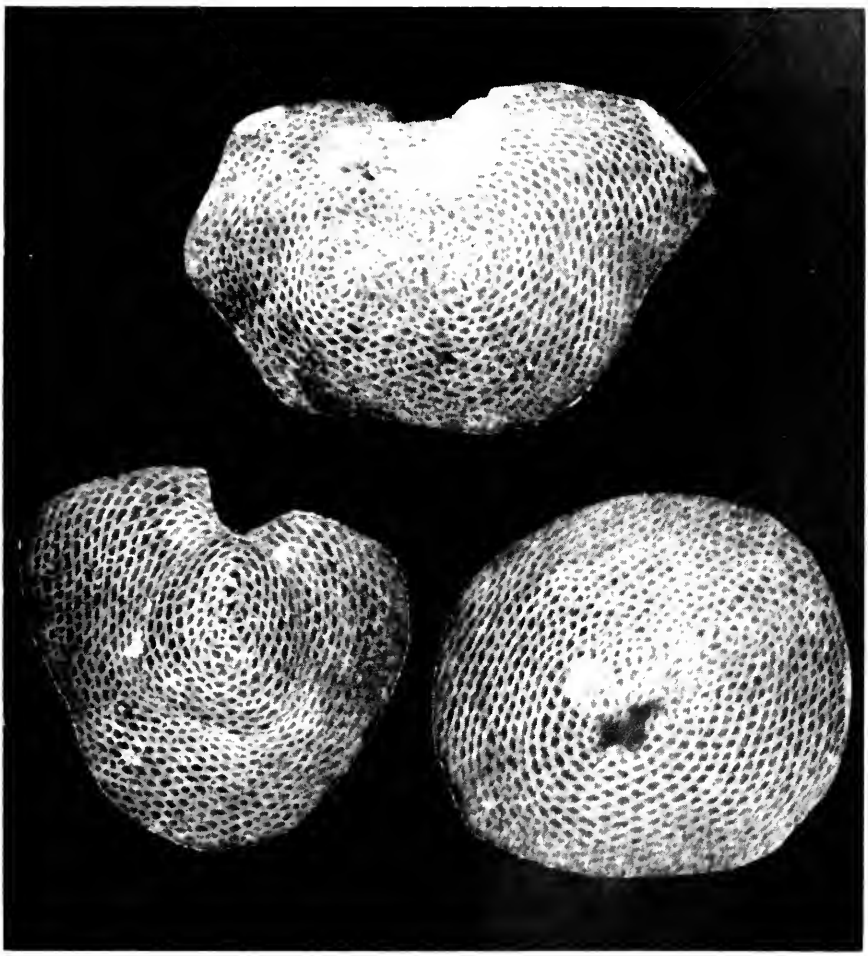

Fig. 116. *Geotrypetes seraphini seraphini* (A. Duméril). Scales of the type, MNHN no. 1256A, from "Gabon," Africa. Lower right scale, 1.3 × 1.5 mm.

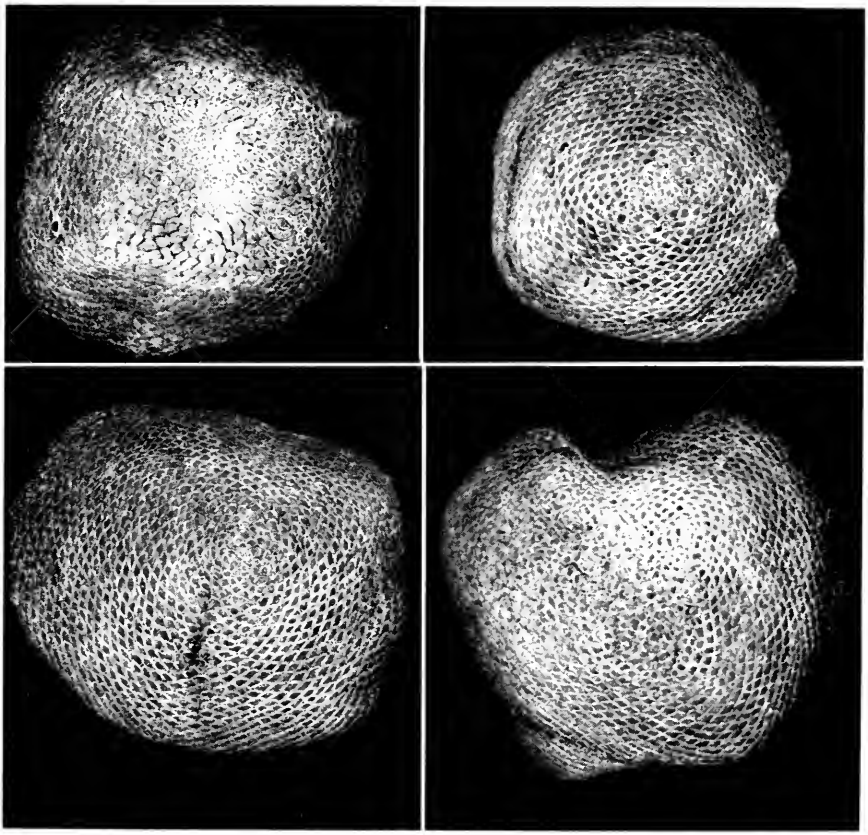

FIG. 117. *Geotrypetes seraphini occidentalis* Parker. Scales from EHT-HMS no. 4654, Harbel, Liberia. Largest (lower right), 1.8 × 2.0 mm; upper left, 1.6 × 1.9 mm.

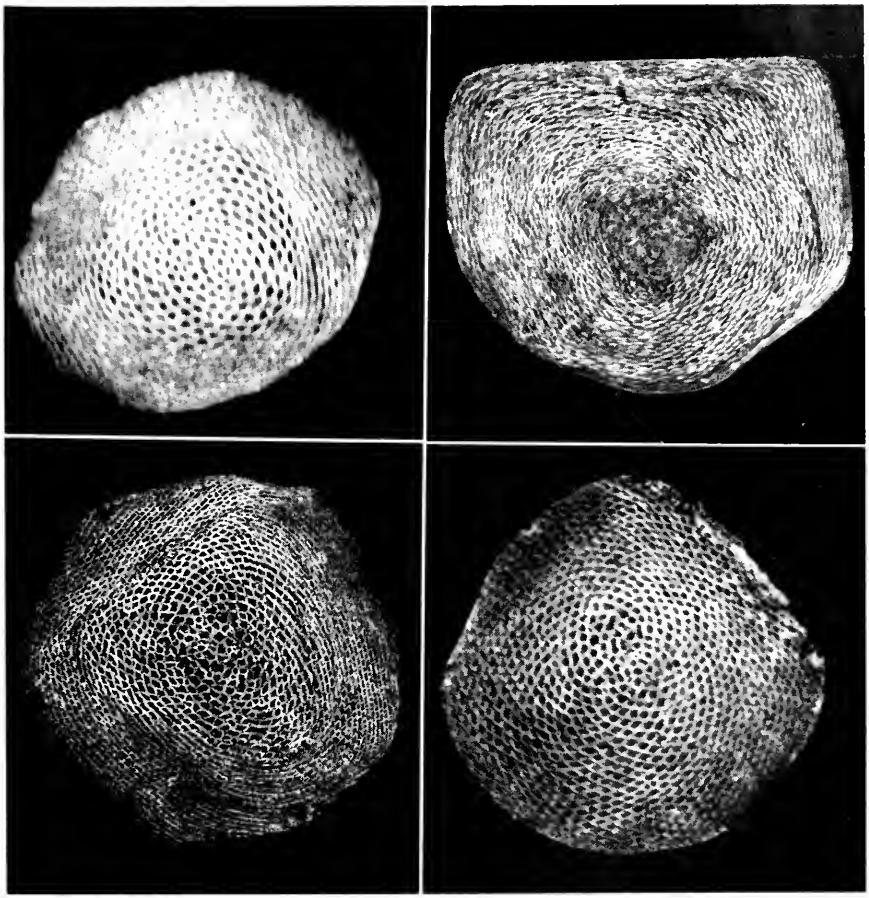

FIG. 118. *Geotrypetes seraphini occidentalis* Parker. Scales from four specimens from three widely separate localities. Upper left, MCZ no. 22401, Ganta, Liberia; upper right, Fernando Po, Gulf of Guinea (doubtfully); two lower from cotype, RNHL no. 6527, Grand Cape Mt., Liberia, Africa.

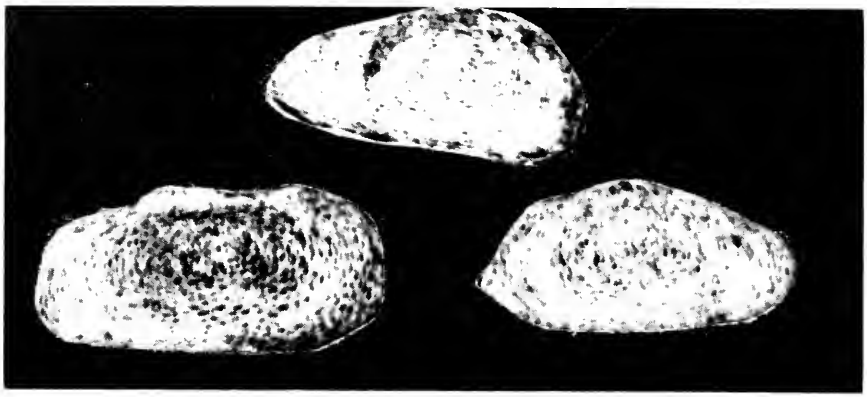

FIG. 119. *Gegenophis carnosus* (Beddome). Scales from EHT-HMS no. 4629, Kotegehar (2 mi. N), Mysore, India. Largest scale about 0.6 × 1.25 mm.

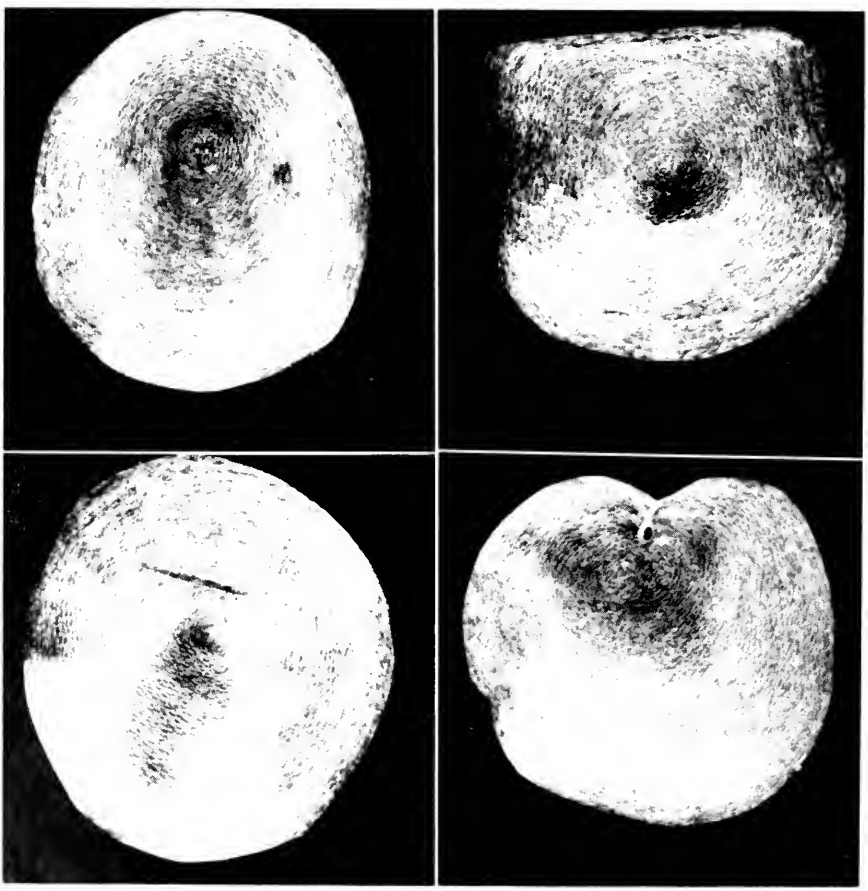

FIG. 120. *Gegenophis ramaswamii* Taylor. Scales from EHT-HMS no. 4630, paratype (exchange Harvard), from Tenmalai Forest (elev. 550 ft.), Kerala (state), India. Largest (lower right), 1.5 × 1.7 mm.

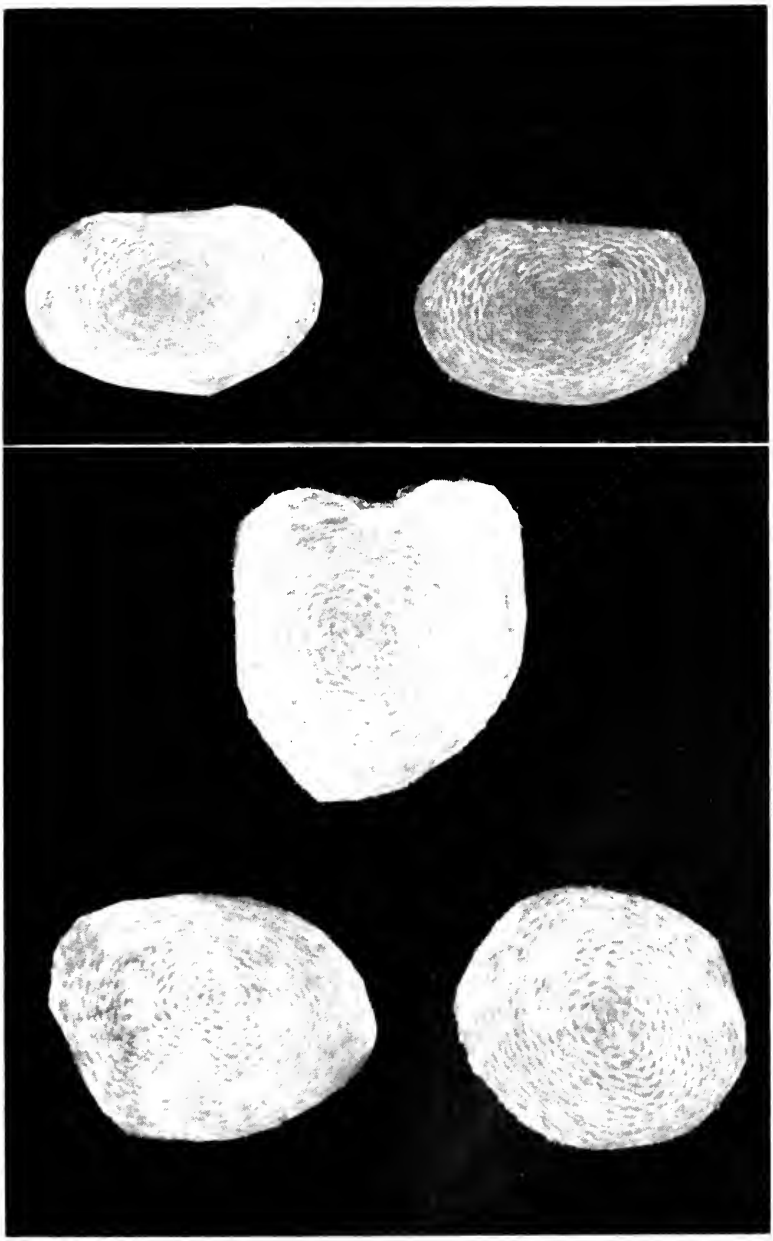

FIG. 121. *Indotyphlus battershyi* Taylor. Two upper scales from type, AMNH no. 49974, Khandala, Poona District, India. Three lower scales from LHT-HMS no. 6954, from "near Bombay, India." Largest scale, 0.65 × 0.8 mm.

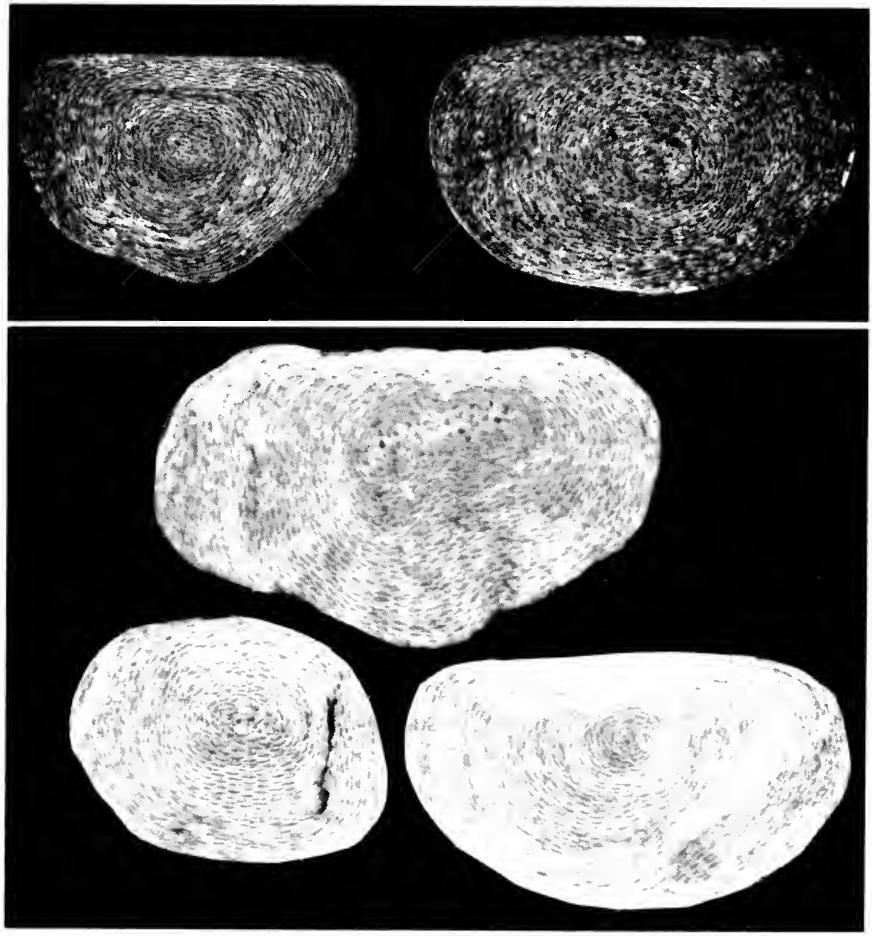

FIG. 122. *Grandisonia alternans* (Stejneger). All scales from type, USNM no. 20418, Mahé, Seychelles. Largest scale about 0.9 × 1.5 mm.

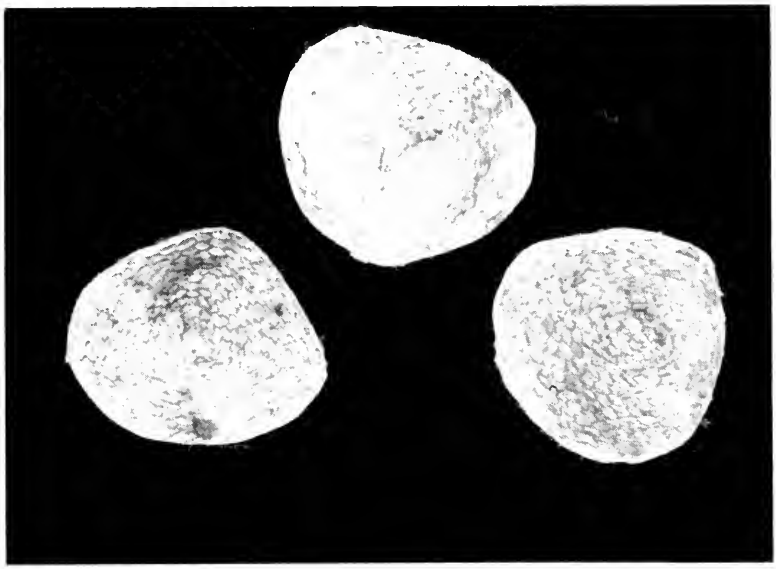

FIG. 123. *Grandisonia diminutiva* Taylor. Scales from type, MCZ no. 1657, Praslin Is., Seychelles. Positive photographs, largest scale (upper) about 0.5 × 0.62 mm.

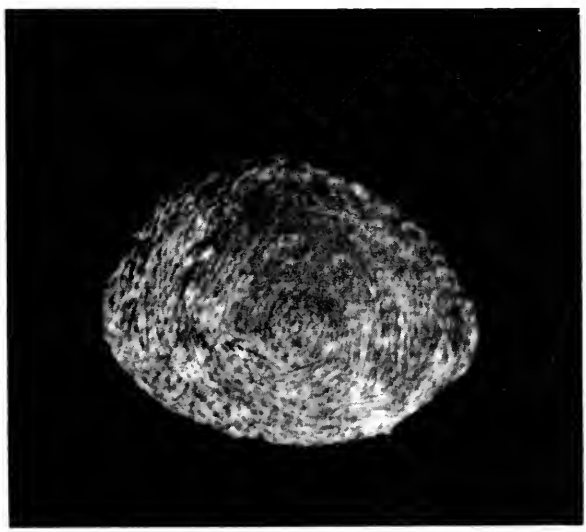

FIG. 124. *Grandisonia larvata* (Ahl). Scale from BMNH no. 1907.10.15.147 (1946.9.5.20), Mahé, Seychelles; type of *Hypogeophis angusticeps* Parker. Size about 0.7 × 0.82 mm.

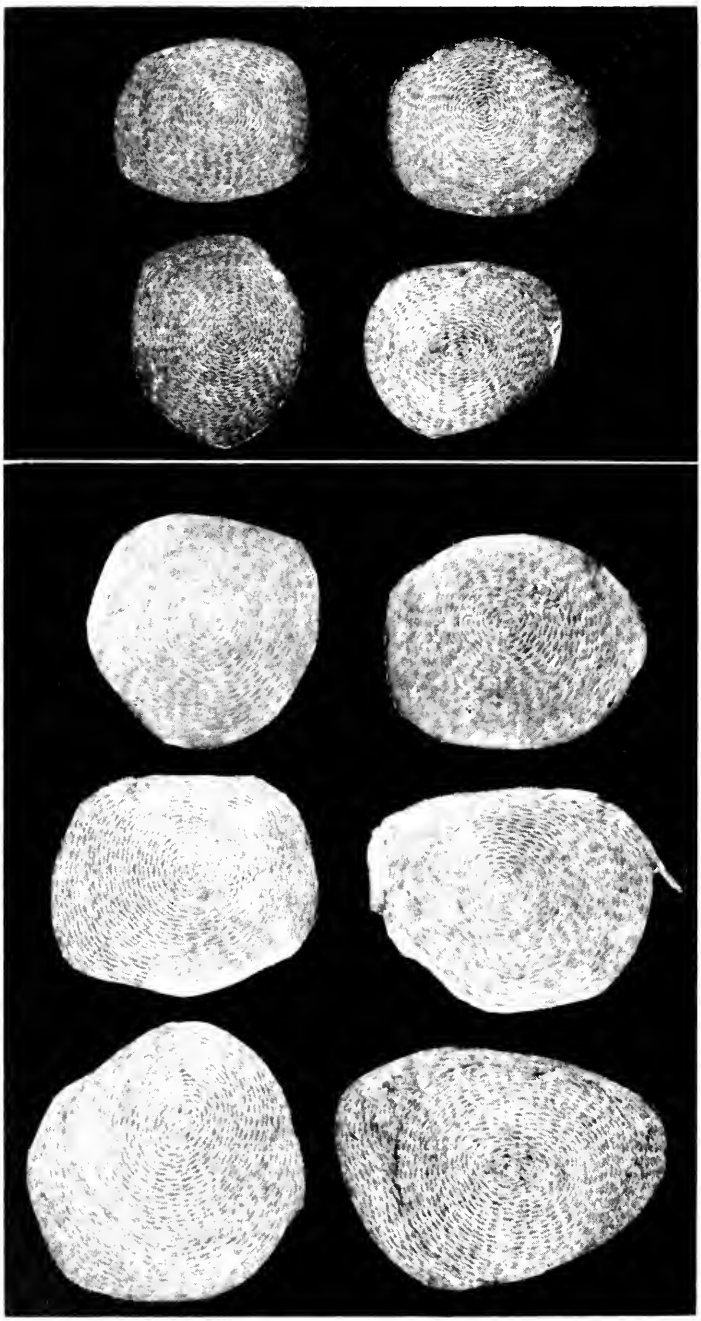

FIG. 125. *Praslinia cooperi* Boulenger. Scales from lectotype, BMNH no. 1946.9.5.17, Praslin Island, Seychelles. Four upper scales from the 3rd cm preceding vent. The largest scale (lower right) measures 1.7 × 2.2 mm.

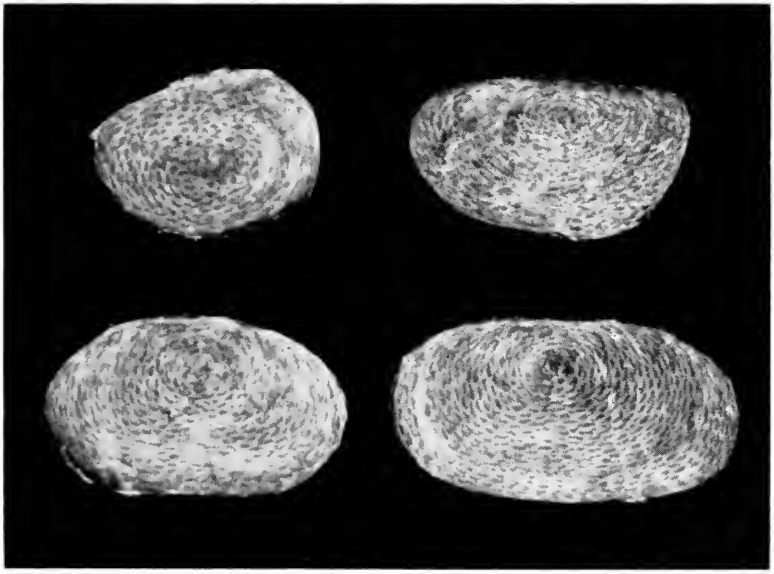

Fig. 126. *Hypogeophis rostratus rostratus* (Cuvier). Scales from EHT-HMS no. 4666, Silhouette I., Seychelles. Two upper from the fourth cm preceding vent. Largest scale about 0.5 × 1.0 mm.

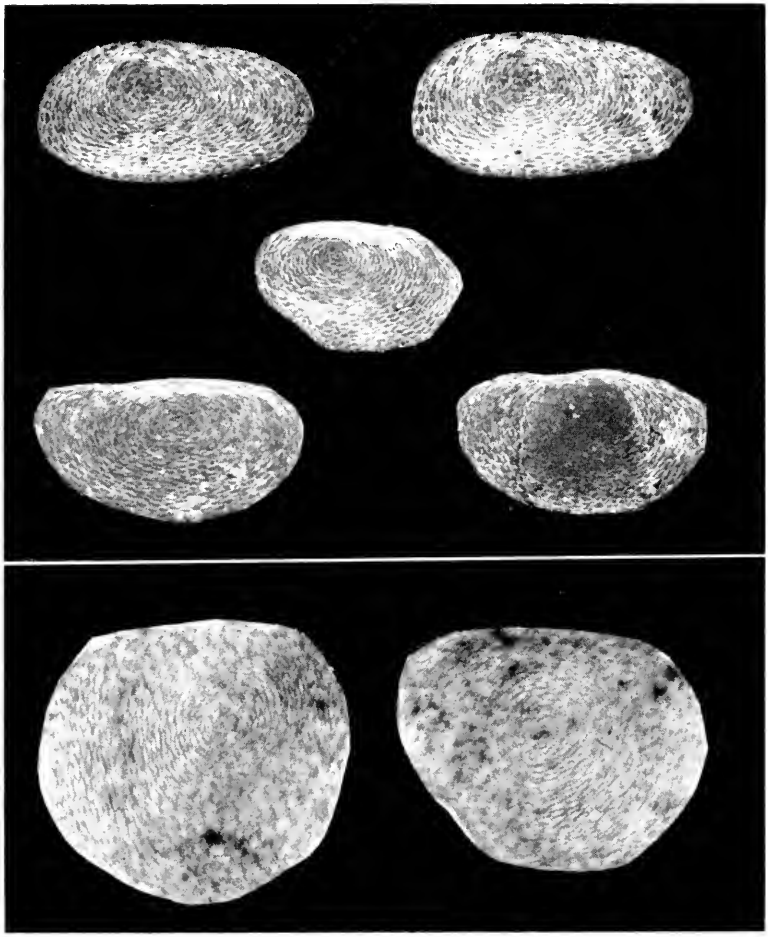

FIG. 127. *Hypogeophis rostratus praslini* Parker. Scales of no. 125, collection of Alan Holman, Praslin Island, Seychelles. Five upper scales from 3rd cm preceding vent. Two lower scales positive photographs.