STUDIES ON AMPHISBAENIANS (AMPHISBAENIA, REPTILIA)

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6. THE GENERA MONOPELTIS AND DALOPHIA IN SOUTHERN AFRICA

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ABSTRACT

The present study reviews all material of the genera *Monopeltis* and *Dalophia* from south of the river Zaire. The name *Dalophia* is resurrected and *Tomuropeltis* returned to synonymy. The taxa recognized are: *M. anchietae* (including *quadriscutata, okavangensis, devisi*), *leonhardi* (including *vernayi*), *c. capensis* (including *decosteri*), *c. rhodesianus* new subspecies, *zambezensis, s. sphenorhynchus* (including *habenichti, gazei*), *s. mauricei* new combination (including *ocularis*), *kabindae, perplexus, remaclei, adercae, scalper* (including *gerardi, bulsi*), *vanderysti* (including *lujae, vilhenai, closei*), *luandae*; *D. welwitschii, angolensis, ellenbergeri, gigantea* (including *truncata*), *longicauda, pistillum* (including *granti, colobura, jallae, transvaalensis, mossambica, kuanyamarum*), *luluae* new combination. Geographic variation is mapped for widely ranging forms and ontogenetic changes in cephalic keratinization are documented.

The review is based on some 1500 specimens, many of them collected as part of the project. All extant types have been reexamined. The present paper also summarizes ecological information gained from collectors, and miscellaneous biological data scattered throughout the literature, and includes an analysis of stomach contents for those species well represented in the Umtali collection.

INTRODUCTION

The African continent is inhabited by an interesting radiation of wedge-snouted amphisbaenians presently classified in the genera *Monopeltis* and *Dalophia*. The assemblage ranges from the northern Cape Province of South Africa north to Cameroun in the west and northern Mozambique (or southern Tanzania?) in the east. Numerous forms have been described; the latest summary lists 32. Yet the only revisions (Loveridge, 1941; FitzSimons, 1943) still show a startlingly high ratio of types to other material.

This situation became clear to us about a decade ago. We consequently began an intensive program of collecting and accumulating specimens, extending across the entire range rather than restricted by a particular political boundary. We report on the assemblage within the area defined by Wellington (1956, fig. 1) as southern Africa, i.e., Africa south of the South Equatorial Divide and an eastern extension along the northern edge of the Rovuma Basin. We also include the relatively limited number of specimens available from localities in the Congo (Zaire) Basin; herein we deal with all forms of this assemblage not treated by Gans and Lehman (1973).

We have attempted to be conservative, hence forms are characterized on the basis of the largest possible series, and it has generally been assumed that individual variant specimens represent just that, rather than the first example of a yet undescribed form. This reflects a conviction that it is most difficult to predict which kind of variation is within or beyond the limits of poorly known species, range of variability being a specific character state. On the other hand, we have not imposed taxonomic changes on some of the situations in Zaire, where only individuals, rather than series of specimens, are now available to document previously described species.

Experience showed that certain meristic characters were much more useful in defining groups than were minor differences in proportions and shape of cephalic, gular, pectoral, or cloacal shields. Several other characters that proved to be singularly useful were arrangement of supernumerary dorsal half-annuli, occurrence and site of an autotomy annulus, and pattern of interannular sutures on the dorsal surface of the tail. Much has been written regarding the occurrence of one or two head shields in the same species. As far as we were able to determine, all such cases fit the pattern in *Monopeltis guentheri* (Gans and Latifi, 1971), in that the suture between two discrete head shields becomes obliterated, starting in its center, due to increasing keratinization. This implies that the frequency of encountering a complete suture is
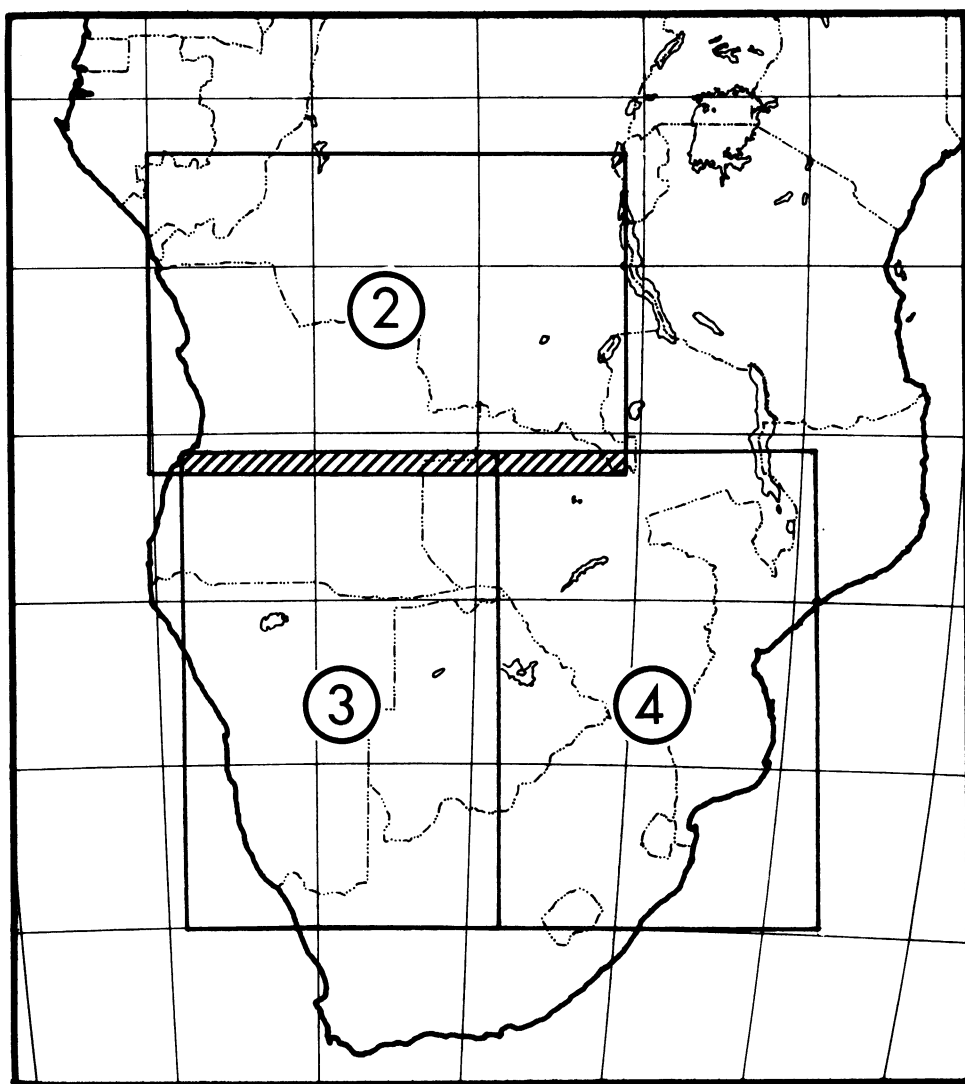
FIG. 1. *Monopeltis* and *Dalophia*. Sketch showing placement of figures 2 to 4.

greatest in juveniles. When small specimens show a single shield and very large specimens show two, it is unlikely that both samples were drawn from the same population.

ACKNOWLEDGMENTS

MATERIALS

The specimens on which this study is based came from localities shown on figures 2-4. The appendix gives map coordinates for all localities. The materials are deposited in the following collections (identified by the abbreviations below). We are grateful to those who facilitated loans and examination of the material.

AMG, Albany Museum, Grahamstown, Cape Province, South Africa (F. H. Farquharson)

AMNH, the American Museum of Natural History, New York (R. G. Zweifel)

ANSP, Academy of Natural Sciences of Philadelphia, Philadelphia (E. Malnate)

BM, British Museum (Natural History), London, England (A. G. C. Grandison and A. Stimson)

CAS, California Academy of Sciences, San Francisco (A. Leviton)

CG, Carl Gans Collection, Ann Arbor

CZL, Centro de Zoologia, Ministerio do Ultramar, Lisbon, Portugal (J. F. L. Nunes, J. V. dos Santos, and Maria M. L. de C. Roque e Pinheiro)

FMNH, Field Museum of Natural History, Chicago, Illinois (R. F. Inger and H. Marx)

GUM, Zoologisches Institut und Museum der Universität, Göttingen, Germany (P. Kuenzer)

HM, Zoologisches Staatinstitut und Zoologisches Museum Hamburg, Germany (W. Ladiges)

IMZUT, Instituto e Museo di Zoologia della Universita di Torino, Italy (Specimens not examined, but abbreviation used in text.)

JV, J. D. Visser Collection, Camps Bay, South Africa

LCFM(MG), Musée de La-Chaux-de-Fonds, Switzerland (J. L. Perret)

MBL, Museu Bocage, Lisbon, Portugal (L. Saldanha and E. G. Crespo)

MCZ, Museum of Comparative Zoology, Cambridge (E. E. Williams)

MD, Museu do Dundo, Dundo, Lunda, Angola (A. de B. Machado)

MG, Museum d'Histoire Naturelle, Geneva, Switzerland (V. Aellen and J. L. Perret)

MHNP, Museum National d'Histoire Naturelle, Paris, France (J. Guibé)

MMK, McGregor Memorial Museum, Kimberley, South Africa (R. T. Hutchings)

MSNG, Museo Civico di Storia Naturale "Giacomo Doria," Genoa, Italy (Lilia O. Capocaccia)

NKW, Kruger National Park, Skukuza, Transvaal, South Africa (U. de V. Pienaar)

NMB, Naturhistorisches Museum, Basel, Switzerland (K. Kramer)

NMBO, National Museum, Bloemfontein, Orange Free State, South Africa (S. W. P. de Waal)

NMP, Natal Museum, Pietermaritzburg, Natal, South Africa (J. A. Pringle)

NMSR, National Museum of (Southern) Rhodesia, collection now at Umtali Museum, Umtali, Rhodesia

NMW, Naturhistorisches Museum, Vienna, Austria (Joseph Eiselt and Franz Tiedemann)

NRM, Naturhistoriska Rijksmuseum, Stockholm, Sweden (Ulf Bergstrom)

RGMC, Musée Royal de l'Afrique Centrale, Tervuren, Belgium (M. Poll and D. Thys van den Audenaerde)

RMNH, Rijksmuseum van Naturlijke Histoire, Leiden, Holland (M. S. Hoogmoed)

SAM, South African Museum, Capetown, South Africa (T. H. Barry and C. E. Gow)

SM, State Museum, Windhoek, South West Africa (C. G. Coetzee and M. J. Penrith)

SMF, Senckenbergische naturforschende Gesellschaft, Frankfurt a. M., Germany (K. Klemmer)

SMNH, Staatliches Museum für Naturkunde, Stuttgart, Germany (H. Wermuth)

TM, Transvaal Museum, Pretoria, South Africa (W. D. Haacke)

UM, Umtali Museum, Umtali, Rhodesia

USNM, National Museum of Natural History, Smithsonian Institution, Washington, D.C. (J. A. Peters and G. Zug)

ZIL, Zoological Institute, U.S.S.R. Academy of Sciences, Leningrad, U.S.S.R. (I. S. Darevski)

ZMA, Zoological Museum, Amsterdam, Holland (D. Hillenius)

ZFMK-H, Zoologisches Forschungsinstitut und Museum Alexander Koenig, Bonn, Germany (Wolfgang Böhme)

ZMU, Zoologisches Museum, Berlin, D.D.R. (Günther Peters)

ZSM, Zoologische Sammlung des Bayerischen Staates, Munich, Germany (W. Hellmich and V. Gruber)

An asterisk (*) precedes the number of a specimen not examined or received too late to have its data included in the tabulations.

Much of the material used was collected by various local naturalists and we acknowledge their assistance. Undoubtedly the greatest single
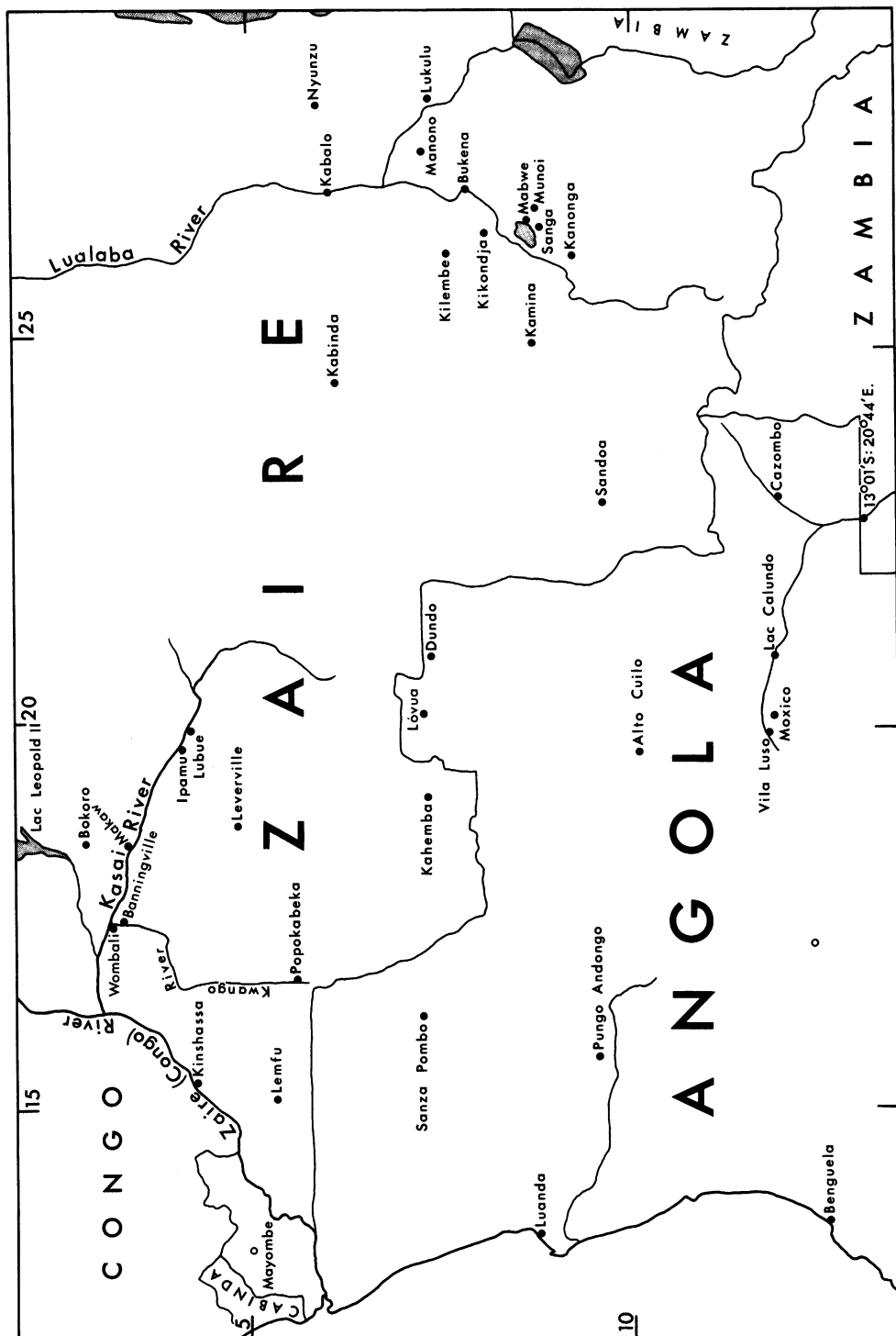
FIG. 2. Map of southern Zaire and northern Angola showing localities mentioned in text. Solid dots indicate precise localities, open circles indicate localities not precisely identified.

15   20

●Benguela

13°01'S:20°44'E.

●Hanha

A N G O L A

●Balovale ●Kabompo

Z A M B I A

●Vila da Ponte

●Liuwa Plain

Kalabo●

15 Capelongo●

●Caquindo

●Lealui

Lukona●

Cubango River

Zambezi River

●Mupa

Humbe●

River

●Mupanda

Cunene

Ruacana

●Seseke

Okavango

Katima Mulilo

Oshakati● ●Ondangua

OVAMBOLAND

Runtu●

C A P R I V I

Bagani●

●Kayas

●Etosha Pan

River

KAOKOVELD

●Warmbad
●Otjovasandu

●Neitsas Fm.

●Grootfontein

Chief's Id.   ●Khwai
Maxwee●   ●Tamafupi

20

Outjo●   ●Hoasas   Waterberg
Omatjenne●   ●Otjosongombe
Otjiwarongo●   ●Ombujomatemba

Maun●   ●Shorobe

Tsau●

●Kaumaha

●Sukses
Quickborn Fm.●●Rugby Fm.
●Omaruru   ●Otjosondu

DAMARALAND

●Labora Fm
Ghanzi● ●Dekar

Okahandja●   ●Ovikorero   ●Kalidona
Teufelsbach●   ●Gravellotte
Otjimbingue●

●Xade Pan
●Gomodimo Pan

Windhoek●   ●Eava Fm.   ●Gobabis

Aub●●Gochegenas
●Rehoboth

B O T S W A N A

Kuke Pan●

SOUTH WEST AFRICA

●Ababis

Tshane●   ●Kang
●Kangyane Pan
Takotokwane Pan●

Khutse
Game Res.

●Lekuru Pan●Khokong

25

●Gibeon   ●Mersa
Fm.

Mabua Sehubi●
Pan   ●Boshu Boholu Pan

Dikgomu-di-Kai●

●Tierkop

Tsabong●

●Bethanie   Rietfontein●

Vryburg●
Schweizer Reneke●

Noenieput●

Lower Molopo

C A P E   P R O V I N C E

Andalusia●

Danielskuil●

Orange   River

Aughrabies Falls   Alhut●Kakamas

Barkly West●
Secretaris●   Kimberley

Douglas●   ●Modder River
●Fort
Richmond
Vroupan●   ●Hopetown

FIG. 3. Map of South West Africa, southern Angola, western Zambia, western Botswana, and northern Cape Province showing localities mentioned in text.

FIG. 4. Map of eastern Zambia, Rhodesia, eastern Botswana, Transvaal, Orange Free State, Malawi, and Mozambique showing localities mentioned in text.

contribution was made by Mr. Richard Japp. While stationed at the WENELA (Witwatersrand Native Labour Authority) depot at Kalabo during 1962-1966, he was responsible for cutting roads and he preserved many fossorial reptiles that were donated to the Field Museum of Natural History, the Transvaal Museum, and the Umtali Museum. The four species of amphisbaenian that were sympatric at Kalabo proved to be of great interest. A large undescribed species of *Zygaspis* was sympatric with a dwarfed population of *Z. quadrifrons* and was subsequently described as *Z. niger* from Japp's material (Broadley and Gans, 1969). The rare and localized *Dalophia ellenbergeri* was sympatric with *Dalophia pistillum* and good series of both forms were obtained.

During the period 1968-1970 Japp was stationed at Katima Mulilo in the eastern Caprivi Strip. The South African authorities bulldozed a cordon along the Zambian and South West African border and Japp arranged to collect all the reptiles turned up by the bulldozers. The area proved extremely rich in burrowing reptiles and in one area no less than six amphisbaenians are sympatric (*Zygaspis quadrifrons*; *Z. niger*; *Monopeltis anchietae*; *M. sphenorhynchus mauricei*; *Dalophia pistillum*; *D. longicauda*). These fine collections were donated to the Umtali Museum.

Mr. Tim Liversedge donated many amphisbaenians from Botswana to the Umtali Museum, the most important series consisting of *Monopeltis leonhardi*, *M. sphenorhynchus mauricei*, and *Dalophia pistillum* from road construction southward from Tshane, southwestern Botswana.

Messrs. A. C. and A. M. Newman collected most of the long series of *Monopeltis capensis* that came from the road construction through the Sabi Valley from Umtali south to Birchenough Bridge and Rupisi Hot Springs.

Mr. Peter Taylor collected the first specimens of *Monopeltis capensis* in the southeastern lowveld of Rhodesia while with the Department of Tsetse Control. He was then transferred to Kariba, where he collected the first specimens of *Monopeltis zambezensis*.

Various officers of the Rhodesian Department of National Parks and Wild Life Management have collected amphisbaenians for the Umtali Museum, mainly when roads or firebreaks were being cut, the principal contributors being

Messrs. F. J. R. Junor (Kariba, 1959), F. H. Middleton-Stokes (Mana Pools, 1963), R. Thomson (Binga, 1966), J. Rushworth (Wankie, 1968), P. J. Wright (Chizarira, 1969), J. Hatton and J. Anderson (Victoria Falls, 1969), A. M. Coneybeare and J. Rushworth (Wankie, 1970), H. J. Herbert (Wankie, 1971) and P. J. Thomson (Chizarira, 1972).

Mr. B. L. Mitchell collected a few amphisbaenians in southern Zambia and the only two *Dalophia* from the Eastern Province of Zambia were collected by Mr. V. J. Wilson. Mr. W. F. H. Ansell collected a number of amphisbaenians in western Zambia.

Long series of *Monopeltis capensis* were collected by Messrs. H. Delport of Bothaville and A. Barnard of Brandfort, Orange Free State. The interesting series of *Monopeltis sphenorhynchus sphenorhynchus* from Waterpoort were collected by Mr. J. M. Froneman of Vetfontein, Transvaal.

Stomach contents of samples of various *Monopeltis* and *Dalophia* species were analyzed by Miss G. Watson and identified by Mr. B. L. Mitchell (termites), Mr. F. C. de Moor (other insects) and Dr. R. F. Lawrence (solifuges).

METHODS

The descriptive and analytical sections of the present paper follow the general pattern established by Gans and Alexander (1962), Gans (1966, 1971), and Gans and Latifi (1971). The distinct organization of the head of the wedge-snouted forms does force some modifications that are stated briefly below.[1]

Body Annuli. The count of body annuli proceeds from that immediately posterior to the enlarged last supralabial to the one just anterior to the precloacal shield. The precloacal pores lie lateral to the shield and thus on the first lateral annulus. Care must also be taken to include all the several rows of modified gular segments. The line along which counts are made starts at the last infralabial and then swings dorsad to pass the

modified pectoral region after which it returns to the level of the fourth or fifth segments ventral to the left lateral sulcus. Only those intercalated partial annuli actually contracting along this line are included.

Counts of annuli made along the dorsal surface are generally higher than those along the ventrolateral line, due to the intercalation of accessory dorsal half-annuli that generally terminate at the lateral sulci. This probably accounts for the much higher counts given in the earlier literature; for instance, Boulenger (1885, p. 453) specifically noted that he counted annuli along the dorsal surface of the trunk. Both number and location of these annuli vary intraspecifically and interspecifically. They are hence tabulated as supernumerary dorsal half-annuli corresponding to the first (1-50), second (51-100), third (101-150), etc., groups of 50 ventrals. We maintain the tradition of emphasizing the number of ventral half-annuli, because analysis of X-ray plates (Alexander and Gans, 1966) has shown that the ratio of these to vertebrae (and presumably somites) does not differ significantly from the integer two, whereas the ratio of dorsals to vertebrae may be fractional and greater than two in these genera.

The number of dorsal half-annuli anterior to and corresponding to the modified and enlarged pectoral segments is given in parentheses preceding the total count of body annuli. The count in parentheses includes those annuli that elongate along the sides of the trunk to contact the sides of the fused, elongated pectorals.

The number of those partial annuli lying between the last body and the first caudal annulus, lateral to the cloacal shield, is recorded as laterals. In the frequent cases of asymmetry the values are recorded left/right. When the enlarged pore-bearing segments that lie lateral to the cloacal cap correspond to more than a single (dorsal half) annulus, all are counted.

Caudal annuli are recorded from the first annulus, ventrally continuous and without significant midventral narrowing, posterior to the cloacal cap. When one postcloacal annulus is significantly narrowed, reduced in diameter, more densely pigmented, or otherwise marked as an autotomy site (or when the tail is missing beyond this point), the count to this autotomy annulus is given in parentheses followed by the

number of caudal annuli (or an X in the case of an autotomized tail). The count does not include the terminal caudal cap proper, whether or not this is smooth and irregularly divided into pie-shaped segments. Portions of a terminal annulus may occasionally have their segments continuous with elements of the terminal cap. Unless this includes the majority of its segments the annulus is considered as the last caudal, but regular modifications have been recorded.

The midbody count is taken approximately midway between the tip of the snout and the cloaca. Since the division into segments, particularly of the middorsal, but also of the ventrolateral portions of annuli may be irregular, counts of at least five annuli are made and the range of segments dorsal to the lateral sulcus (/) over the range of segments ventral to the lateral sulcus is tabulated. (As in previous studies of this series the raphes between segments are often visualized by spraying the specimen with a weak alcoholic solution of methylene blue. This acts as a surface stain, and sharply defines discontinuities. The color disappears completely in less than an hour after return to preservative.)

Measurements. Snout-vent and tail length were recorded by adpressing the specimens to a meter stick. Midbody diameter was recorded with calipers. The poor state of preservation of much of the material made this measurement less accurate than the others.

Pores. Pores or pore scars were counted regardless of the presence of a core.

Head Segments. Supralabials, infralabials, and postgenials were routinely recorded, as was the general pattern of head shields. Head shield pattern was coded (fig. 5) for all southern specimens of *Monopeltis.* Contact between the nasal segments combined with an elongate head shield was also noted; this correlates well with the occurrence of an elongate, sharply truncate tail and, with rare exception, represents an indicator of the species group defined as *Dalophia.* The contact or absence thereof between the posterior extension of the nasal shield and the ocular or preocular was checked after the initial analysis. The occurrence of a discrete postnasal was found to vary randomly and asymmetrically in most species, both in terms of its occurrence and of the site of the suture between nasal and postnasal.

Pigmentation. Table 1 gives a code of pigmentation patterns observed and tabulated for southern specimens. Pattern D stands for un-pigmented specimens, and presumably includes those that have faded completely.

SEPARATION OF THE SPECIES

GENERAL

Even a preliminary scanning of the data indicated that, across much of the range, there were two kinds of animal, a first group (*Monopeltis*) with short or long tail invariably ending in a rounded, or sometimes laterally compressed, tip and a second group (*Dalophia*) with a long tail that was invariably truncate distally. (Here and below we have added reference in parentheses to the names ultimately applied to the taxa. This is entirely for the convenience of the reader, as decision of the appropriateness of names obviously followed rather than preceded analysis.)

Within the southern portion of the region there were almost no specimens clearly intermediate between these assemblages. Table 2 presents the major characteristics upon which these southern forms may always be defined.

One northern form represented by three specimens from eastern Angola proved to be intermediate, or rather to lack several characteristics defining the separation of the other groups. However, this species did retain the truncate tail and general body pattern of the seemingly more derived species and we here treat the groupings as distinct genera.

## ANALYSIS OF *MONOPELTIS*

INITIAL DIVISION

The number of specimens available and the density of records is much greater for southern Africa than for the northern portions of the range. Analysis hence proceeded north from this region. Initial analysis of nondimensional species (Gans, 1966) suggested the following pattern:

(I) The region (fig. 6) from the northern Cape

TABLE 1
Key to the Pigmentation Patterns Used for Primary Sorting in Southern Specimens

Pigmentation Pattern	Description
A	Heavy pigmentation on dorsal surface from nuchal region to tip of tail; sometimes seen on head shield. Coloration extends 4, 5 segments ventral to lateral line and in lateroventral region often concentrated at interannular raphes. Midventral region generally free of pigment and light in color.
B	Regions of light pigmentation occurring intermittently from nuchal region to tail. May or may not extend completely to tip of tail. Little or no pigmentation ventral to lateral line.
C	Light dorsal pigmentation originating around the fiftieth to 100th body annulus and extending onto tail. Some pigmentation on anterior lateral annuli. No ventral pigmentation.
C	Light to dark pigmentation on dorsal part of caudal annuli only.
D	Unpigmented.
E	Discrete pinpoint speckling originating around the fiftieth to 100th body annulus and extending onto tail. Tip of tail may not show speckling. Dorsal segments do *not* appear shaded. Ventral body surface unpigmented, but some pinpoint speckling may be present on ventral surface of tail.
F	Light scattered speckling on dorsal segments originating at fiftieth to 100th body annulus and becoming progressively heavier posteriorly, extending on to the tail where it becomes very dense. Tip of tail is unpigmented. Ventral pigmentation limited to caudal region and occasionally to an area just anterior to cloaca.
G	Dorsal surface of posterior third of trunk and the tail covered with solid gray pigmentation.
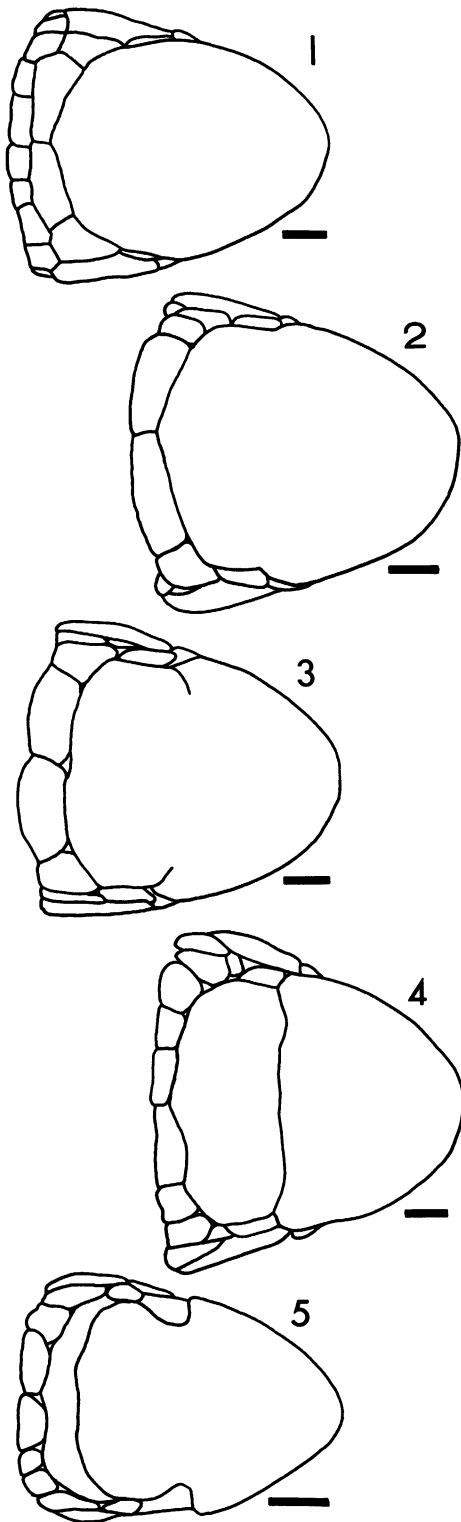
Province and the Orange Free State to the northern border of Rhodesia and into South West Africa in the west and Mozambique in the east is occupied by a geographically variant assemblage (*M. capensis*) with a single head shield, most specimens of which showed a significant number (10 to 30) of supernumerary dorsal half-annuli. The northern range of the assemblage is unclear as there are isolated records from southern Angola, Zambia, and Malawi.

(II) The western portion of the region (fig. 6) extending from South West Africa into northern Botswana contains a number of records of a second form (*M. anchietae*) very similar to and apparently sympatric with the first in various localities, but distinguished superficially by a transversely subdivided head shield (type 4), a greater midbody diameter, and significantly darker dorsal pigmentation.

(III) Another form (*M. leonhardi*) is found mainly in Botswana and Rhodesia (fig. 6), but is sympatric with forms I and II in central South West Africa. Forms II and III differ as the latter lacks precloacal pores, always has six rather than four pectoral shields and has fewer segments in the parietal row.

(IV) A fourth group (*M. sphenorhynchus*) is characterized by body annuli near 290, no supernumerary dorsal half-annuli, a more slender body, and a high number of dorsal segments. It was found (sometimes sympatrically with Forms I and II) at scattered localities (fig. 7) ranging from southern Botswana and eastern South West Africa into western Rhodesia and Zambia. These specimens show affinity to specimens from the northern Transvaal, southern Mozambique, Tongaland, and "Sicumba, Tanzania" that are characterized by 227 to 280 body annuli, no extra dorsal segments and higher numbers of dorsal and low ventral segments to a midbody annulus. Smaller specimens of this assemblage may show a partial or complete transverse division of the large head shield.

(V) The middle Zambezi Valley (fig. 7), where this forms the border between Rhodesia and Zambia, contains various specimens of a fifth form (*M. zambezensis*) reminiscent of Form I, but differing in several characteristics.

FIG. 5. Five basic head shield patterns for *Monopeltis* and *Dalophia* in southern Africa.

(VI) One locality in southern Angola (fig. 7) yields a small sample of five specimens (*M. perplexus*) differing from all others in number of body and caudal annuli, in presence of dorsal sulci and numerous other characteristics.

(VII) A single juvenile specimen from Kabinda (fig. 7) in Zaire (*M. kabindae*) is clearly distinct from all adjacent samples in its simple pattern of pectoral shields and complete fusion of head shields (in a juvenile specimen) and in a constellation of other characteristics.

(VIII) Four specimens from southeast Zaire (fig. 7) (*M. remaclei*) are clearly distinct by a combination of large size, stout body, lack of autotomy on the medium-sized tail and other characteristics.

(IX) Two specimens (*M. adercae*) from localities slightly to the south of form VIII (fig. 7) are similar to the latter in being large and having a long tail that lacks an autotomy site but differ, among other characteristics, in possession of a preocular, a more slender and elongate body and tail and a curious pattern of caudal segments.

(X) A series of some two-dozen smallish specimens (*M. scalper*) from a group of localities around Lac Upemba (fig. 7) is distinct from the parapatric Form IX as well as from forms with which it is allopatric.

(XI) A series of some 15 localities across western Zaire and northern Angola (fig. 7) provides a group of specimens (*M. vanderysti*), with a diagnostic dumbbell-shaped pattern of cephalic keratinization.

(XII) Finally there is a set of three specimens from Luanda, Angola (fig. 7) (*M. luandae*) that differ from Forms VI, X, and XI.

TABLE 2

Character States for Composite Sample from Southern Africa

	Monopeltis (Southern Africa only)	*Dalophia*
Number	N=1477	N=270
Ranges:		
Ventral annuli	170-316 (99% under 300)	264-352 (93% over 300)
Caudal annuli	4-24 (61 in *adercae*)	17-46
Precloacal pores	0-2 (most have 2)	none
Frequencies:		
Anterior Laterals 6	1	1
7	27	0
8	565 } 88%	3
9	692	38½
10	152	134
11	15	76½ } 84%
12	–	7
Characters:		
Head Shield	1 or 2	Generally single with partial suture
Snout (adults)	Short, rounded	Elongate, pointed
Nasals	Usually well separated	Usually in contact or narrowly separated
Tail	Usually short to medium, tip rounded	Elongate, tip sharply truncate
Dorsal surface of tail	Interannular sutures straight, segments discrete	Interannular sutures chevron-shaped, segments tend to fuse
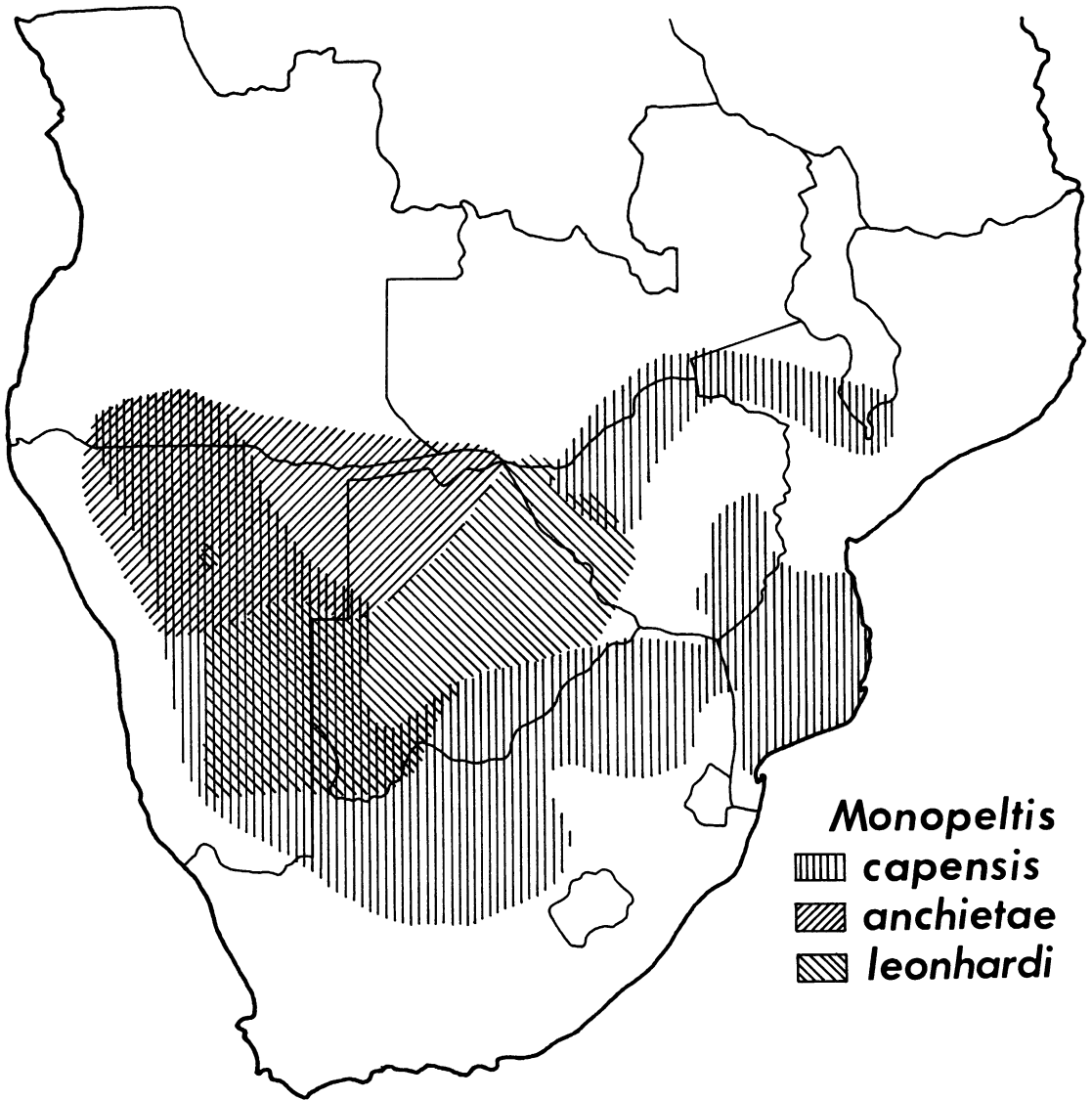
FIG. 6. Distribution of *Monopeltis* Forms I (*capensis*), II (*anchietae*), and III (*leonhardi*).

DETAILS

The several problems of this arrangement are now discussed in sequence.

South West Africa: Figure 8 maps the western localities from which Forms I, II, and III were recorded. All three are sympatric at Waterberg, Okahandja, and Kalidona. Forms I (*M. capensis*) and II (*M. anchietae*) are sympatric at Humbe,

Angola; Forms I and III (*M. leonhardi*) are sympatric at Windhoek, Gobabis, Bethanien, and 40 km. W of Ghanzi, and Forms II and III are sympatric at Otjosomgombe and Otjarondyupa. The basic comparison was made with the material from Okahandja (table 3), with the initial separation being on the basis of single versus divided head shields. One juvenile speci-

men represents an exception. Except for its divided head shield (type 4) this individual (FMNH 75711, snout-vent length 129 mm.), fits all the characteristics of Form I. This suggests

Monopeltis

K kabindae

P perplexus

▥ remaclei

A adercae

▤ scalper

▨ vanderysti

▨ sphenorhynchus   z zambezensis   L luandae
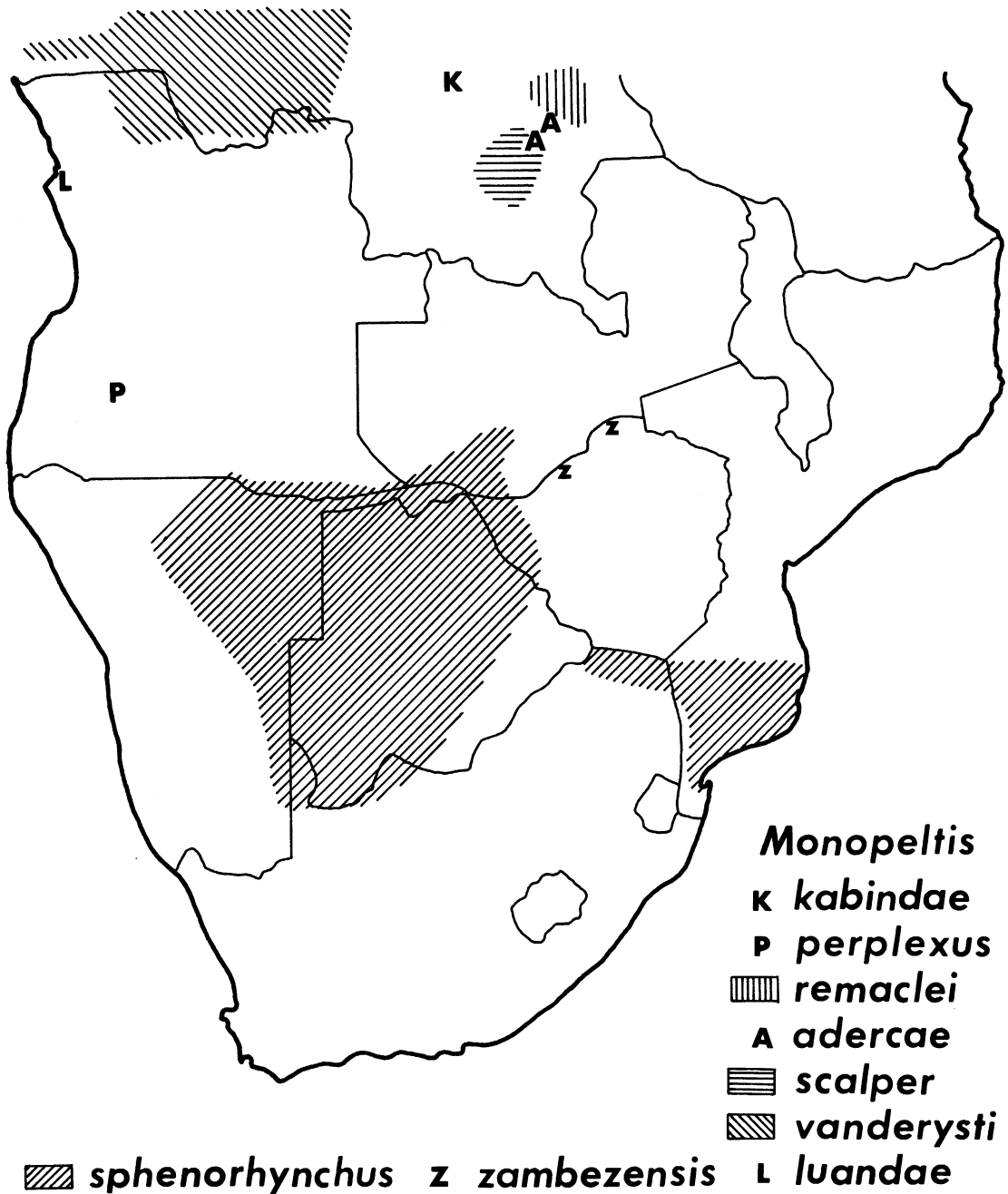
FIG. 7. Distribution of *Monopeltis* Forms IV to XII. See text for key.
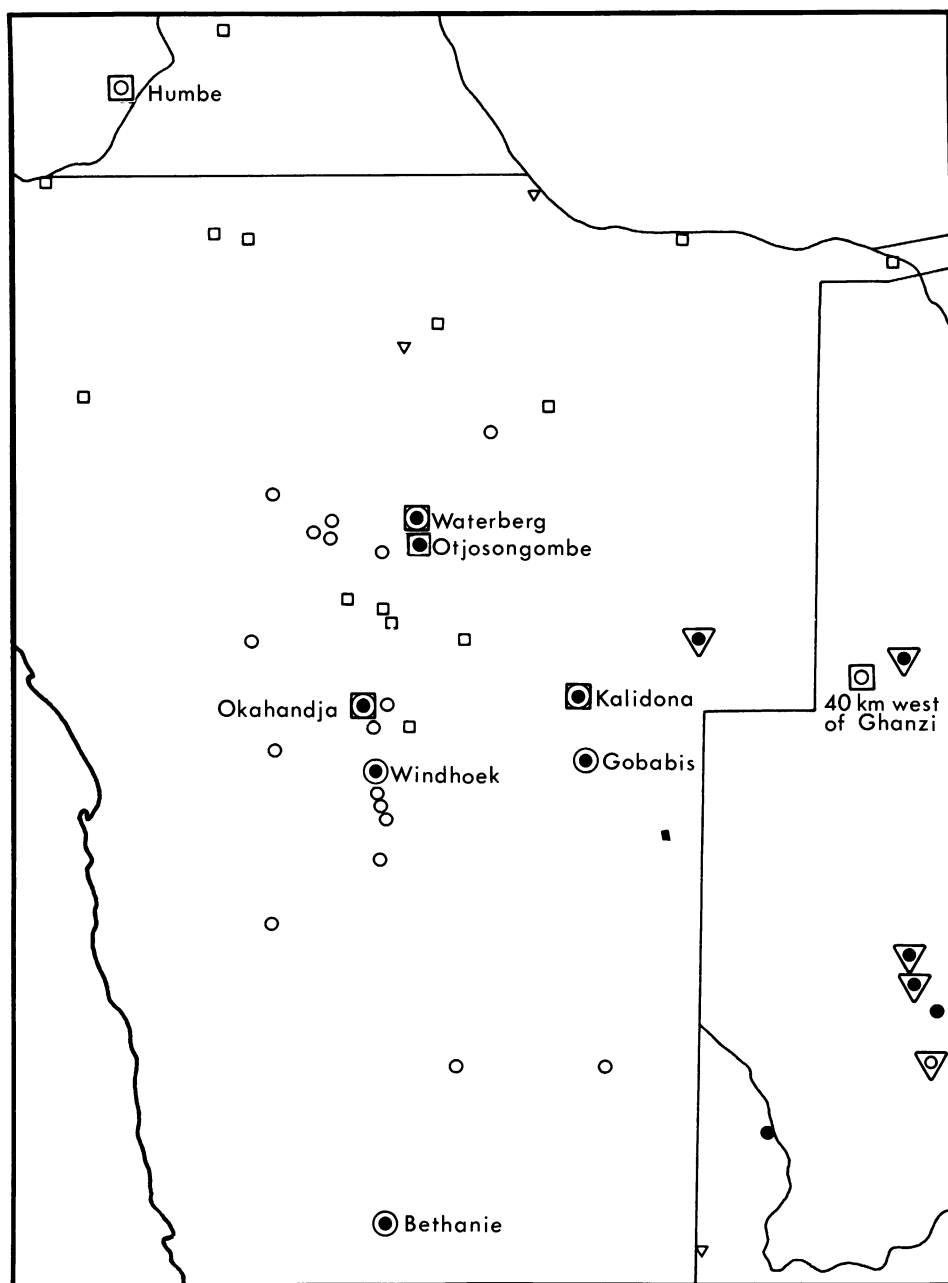
FIG. 8. Distribution of *Monopeltis* in South West Africa and adjoining territories. Open circles = Form I (*M. capensis*); squares = Form II (*M. anchietae*); solid dots = Form III (*M. leonhardi*) and open triangles = Form IV (*M. sphenorhynchus mauricei*).

that Form I undergoes ontogenetic change in head shield pattern at Okahandja, as previously described from *Monopeltis guentheri* (Gans and Latifi, 1971). Ten other specimens from South West Africa have divided head shields but otherwise agree with Form I. Only two of these

originate from localities where Forms II or III occur (Waterberg and Windhoek). The Windhoek specimen (SM 1715) is the largest (256 mm.) of the Form I specimens showing head shield type 4. Five of the other specimens come from

Ombujomatemba, two from Eava and one from Ababis in South West Africa.

The group of specimens with divided head shields throughout life was initially subdivided on the basis of presence (Form II = *M. anchietae*)

TABLE 3
Character States for Samples of *Monopeltis* from Okahandja, South West Africa

		capensis capensis		*anchietae*		*leonhardi*	
Number		N=31		N=10		N=3	
Ranges:							
Ventrals (mean)		182-207 (192.0)		177-182 (179.7)		177-194 (186.7)	
Laterals		3-6		5-6		4-7	
Caudals		5-9		7-8		5-7	
Extra dorsals		13-21		6-20		13-18	
Dorsal segments		23-32		19-25		22-34	
Ventral segments		19-34		15-18		15-27	
Tail segments		25-50		17-30		?	
Frequencies:							
Laterals	3	8+8/2	= 40%	—		—	
	4	9+12/2	= 50%	—		1+1/2	= 50%
	5	5/2	= 8.3%	4+2/2	= 50%	2/2	= 33%
	6	1/2	= 1.7%	4+2/2	= 50%	—	
	7	—		—		1/2	= 17%
Caudals	5	1	= 3.3%	—		1	= 33.3%
	6	2	= 6.7%	—		1	= 33.3%
	7	4	= 13.3%	3	= 30%	1	= 33.3%
	8	13	= 43.3%	7	= 70%	—	
	9	10	= 33.3%	—		—	
Precloacal pores	0	5	= 16.7%	—		3	= 100%
	1	3	= 10.0%	—		—	
	2	22	= 73.3%	10	= 100%	—	
Parietals	4	18 ⎫		—		1 ⎫	
	5	5 ⎬	= 92.6%	—		— ⎬	= 100%
	6	2 ⎭		—		2 ⎭	
	7	—		—		—	
	8	2		3 ⎫		—	
	9	—		3 ⎪		—	
	10	—		3 ⎬	= 100%	—	
	11	—		1 ⎭		—	
Pectorals	4	—		10	= 100%	—	
	5	—		—		—	
	6	—		—	′	3	= 100%
Pigmentation	A	2	= 6.5%	9	= 90%	—	
	B	10	= 32.2%	1	= 10%	1	= 33.3%
	C	14	= 45.2%	—		1	= 22.3%
	D	5	= 16.1%	—		—	
	E	—		—		1	= 33.3%

or absence (Form III = *M. leonhardi*) of preanal pores. Form III also differs from Form II in having fewer parietals and more pectorals (fig. 10). In the more eastern regions Forms I and III

are usually allopatric, the exception being at Malugwe Pan, southeastern Rhodesia (fig. 9, inset).

There is no reason to argue that these three
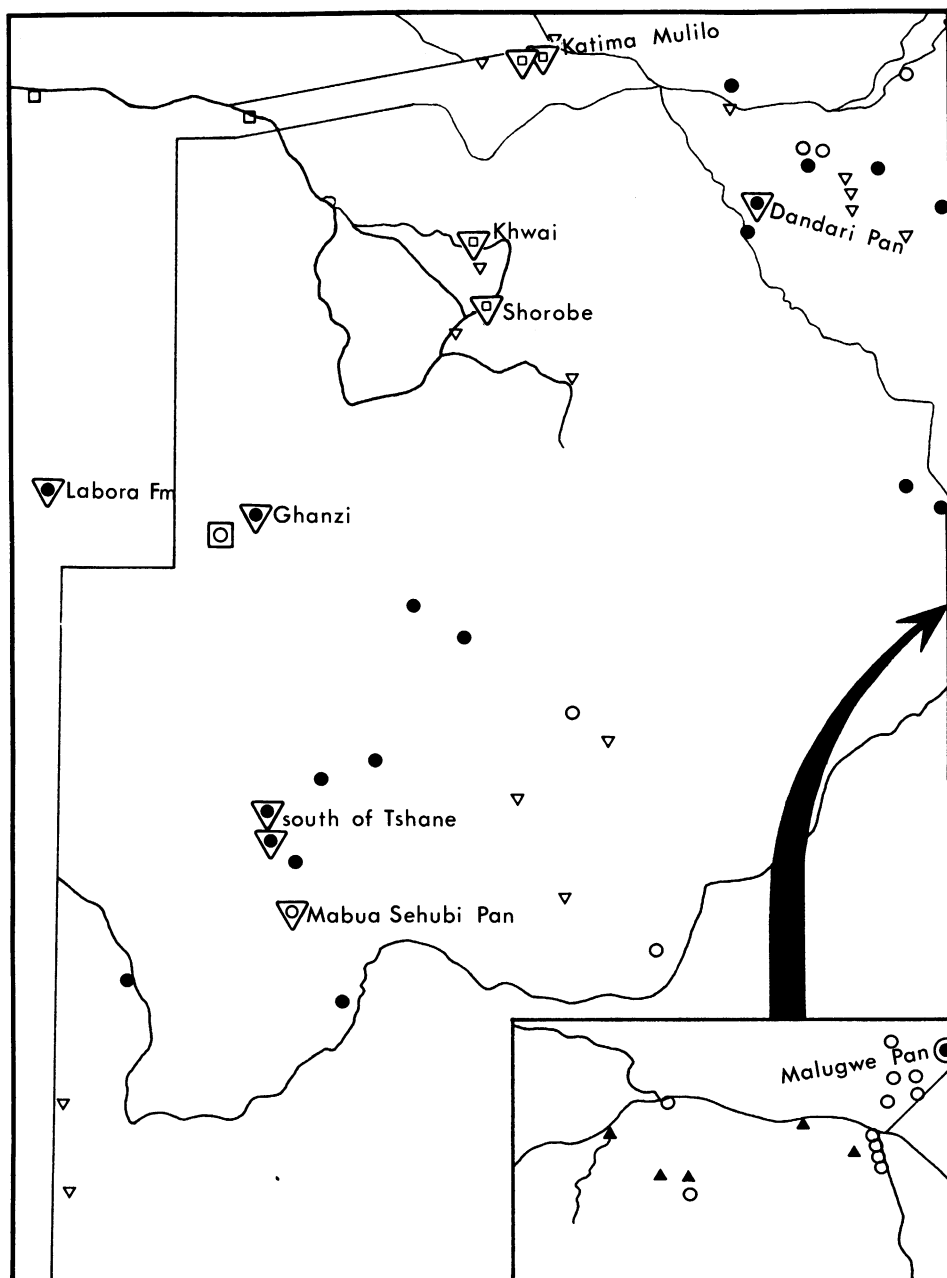
FIG. 9. Distribution of *Monopeltis* Forms I, II, III, and IV in Botswana and adjoining territories. Symbols as in figure 8, but solid triangles = Form IV (*M. s. sphenorhynchus*).
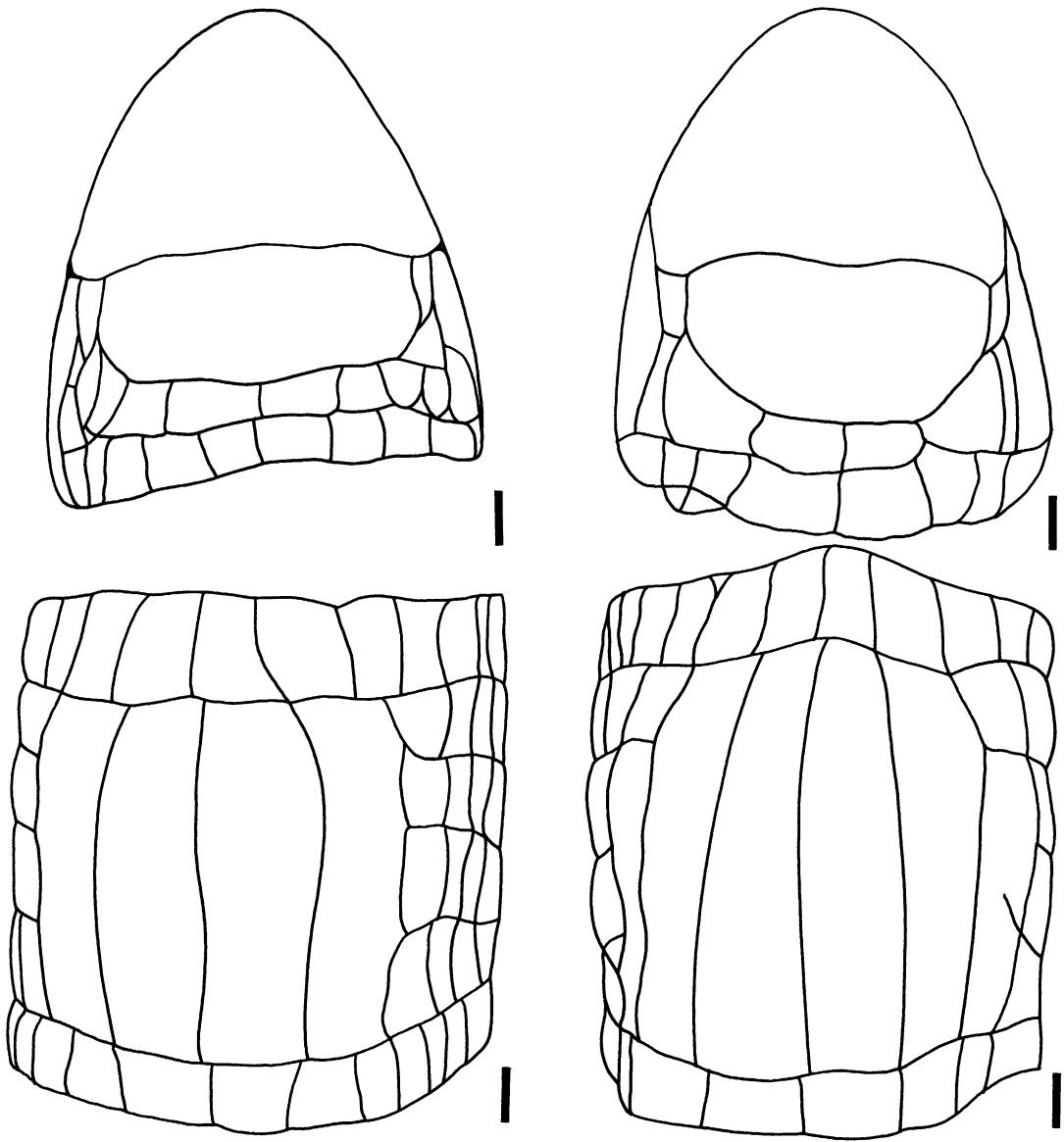
FIG. 10. Forms II (*M. anchietae*) and III (*M. leonhardi*) differ in number of segments in first transverse row of parietals (top) and number of segments to pectoral shield (bottom). Left. Form II (SAM 19715c; Runtu, Okavango, South West Africa). Right. Form III (HM 2893c; Waterberg, South West Africa). (The occurrence of only one postocular, as in SAM 19715c, is common in *M. anchietae*.) The lines equal 1 mm. to scale.

forms do not behave as good species in southwest Africa.

Botswana, the Caprivi Strip, and North-western Rhodesia: Form IV (*M. sphenorhyn-chus*) is sympatric with Form I (*M. capensis*) at Mabua Sehubi Pan, southern Botswana, with Form II (*M. anchietae*) in the vicinity of Katima Mulilo, Caprivi Strip, and at Khwai and Shorobe

in northern Botswana, and with Form III (*M. leonhardi*) at Labora Farm, South West Africa, Ghanzi and south of Tshane, Botswana, and Dandari Pan in northwestern Rhodesia (fig. 9). Form IV is readily distinguished from all others by its high counts of ventral annuli and dorsal segments in a midbody annulus, by the presence of an elongate quadrangular ocular, and by the much more attenuated body. It is clearly a distinct species.

Northern Transvaal: Form IV (*M. sphenorhynchus*) is parapatric with Form I (*M. capensis*) in the northern Transvaal (fig. 9, inset). Form IV has been recorded from the Magalakwin/Limpopo Confluence (holotype of *gazei* Fitz-Simons), Philipstown Farm, Waterpoort, Nwanedzi River, and Madzaringwe Firebreak on the northwestern boundary of the Kruger National Park. Form I has been taken at Weipe Farm, Rochdale Farm, and at a series of localities along the northeastern boundary of the Kruger National Park. The two forms show marked differences in number of ventral body annuli, supernumerary dorsal half-annuli, first post-genials, and pigmentation (table 4).

Middle Zambezi Valley: Six specimens from this region (Form V), four from Ukubula Island in Lake Kariba near the Bumi Confluence and

two from the Mana Pools access road in the Urungwe District, exhibited unusually high counts of body annuli. Although such characteristics as the presence of pores and high counts of segments on a caudal annulus suggested that they were part of the Form I assemblage, they are farther set off from this assemblage by having more caudal annuli than do specimens of Form I from the general region and fewer dorsal than ventral annuli (i.e., negative numbers of supernumerary dorsal half-annuli). Their pigmentation is furthermore restricted to the dorsal part of the caudal annuli. Also, all were small (17 cm. or less) and slender (3 or 4 mm.).

The northernmost specimens typical of Form I (fig. 9) are characterized by very low numbers of supernumerary dorsal half-annuli, lower numbers of ventral segments to a midbody annulus (down to 14), and about 200 body annuli. The sharp differences in characters and trends (table 5) indicated that the specimens from the Bumi Confluence and Mana Pools Game Reserve were not members of the Form I assemblage, but rather a sibling form (*M. zambezensis*).

Southern Angola: Extreme southern Angola has sympatric records of Forms I and II (*M. capensis* and *M. anchietae*) for Humbe (see
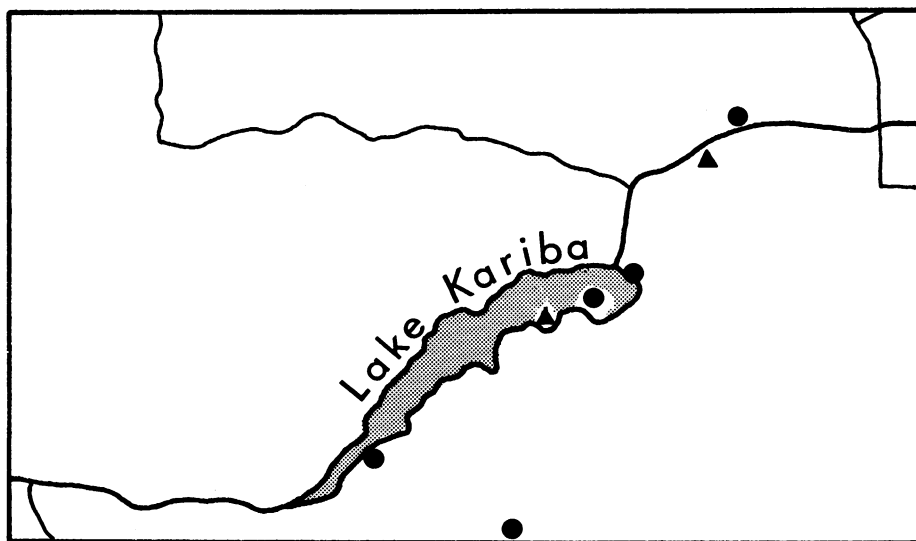

FIG. 11. Distribution of *Monopeltis* Forms I and V the middle of Zambezi Valley. Solid dots = Form I (*M. capensis*); solid triangles = Form V (*M. zambezensis*).

TABLE 4
Character States for Samples of *Monopeltis* from the Northern Transvaal

		capensis capensis	*sphenorhynchus sphenorhynchus*
Number		N=8	N=8
Ranges:			
Ventrals		203-209	234-240
Laterals		4-5	3-5
Caudals		9-11	8-10
Extra dorsals		10-27	1-(−3)
Midbody segments			
dorsal		19-32	31-37
ventral		20-26	20-26
Pigmentation		C	E
Frequencies:			
Laterals	3	−	½
	4	5	5
	5	2	2½
Caudals	8	−	2
	9	1	5
	10	3	1
	11	3	−
Upper labials	2	−	5½
	3	8	2½
Lower labials	2	½	1½
	3	7½	6½
Postgenials			
First row	2	1	8
	3	1	−
	4	6	−
Second row	4	−	1
	5	−	7
	6	−	−
	7	6	−
	8	2	−
Head shield		3 (2 in one)	2
Pores		0-2	2

discussion of the "types" of *Monopeltis spheno-rhynchus*). Slightly to the north we have a sample of five specimens from "Hanha or Cape-longo" and deriving from the Vernay-Lang Angola expedition of the American Museum of Natural History. These specimens, which are allopatric from all other forms, differ from I and II in the presence of a dorsal sulcus, more numerous body annuli, caudal autotomy and a

longer tail, as well as minor differences in various other characteristics. The sample is clearly distinct and is here recognized as a good species (*M. perplexus*).

Kabinda, Zaire: There is only a single specimen from Kabinda (Kasai Province), caught in 1930 with no additional specimens since. The individual is clearly distinct from all other animals taken in northern Angola, Zambia, and

TABLE 5
Character States for Samples of *Monopeltis* from the Middle Zambezi Valley

		capensis capensis	*zambezensis*
Number		N=15	N=7
Ranges:			
Ventrals		198-218	226-263
Laterals		3-5	3-5
Caudals		6-9	6-8
Extra dorsals		(−1)-8	(−7)-(−1)
Midbody segments			
dorsal		14-25	17-21
ventral		12-20	15-18
Frequencies:			
Anterior laterals	8	10½	2
	9	4½	4
	10	−	1
Caudals	6	2	1
	7	5	1
	8	4	5
	9	3	0
Pectorals	4	11	1
	6	4	6

Zaire. Although small, the specimen has a single azygous head shield without trace of past dividing lines. It lacks precloacal pores, caudal autotomy, and supernumerary dorsal half-annuli and has a simple pectoral arrangement with elongate parallel segments. The counts and meristic data suggest affinity with *Monopeltis capensis*, and the individual may represent a northern isolate of this species. The extensive hiatus in the range militates against this; the closest records come from more than 1000 km. to the south and there are adequate samples of other amphisbaenians from the intermediate zone. As this unique specimen is the type of *Monopeltis kabindae*, we here retain the form as a good species until additional material becomes available.

Large Specimens of Southeastern Zaire: There are six specimens pertaining to Forms VIII (*M. remaclei*) and IX (*M. adercae*) from a series of localities in southeastern Zaire. The former was taken at Lukulu, Kabalo, and Nyunzu, the latter at the more southern localities of Bukena and Manono. Consequently there is no indication of

sympatry. All specimens share a relatively long tail that lacks an autotomy annulus, a pair of azygous head shields, some similarity of pectoral and cephalic segmentation (such as a broken up "third" supralabial), and of pigment pattern as well as the replacement of a dorsal sulcus by a diagonal folding pattern. This suggests that we may be dealing with races of a single species distinct from all those previously characterized.

However, the small samples are distinct in several important characteristics. Form IX has a much longer tail and a much more slender trunk as well as differences in most meristic characters. It has clearly defined preoculars (absent in all specimens of Form VIII) and, most important, shows a pattern of caudal segment architecture unique among the specimens thus far examined. The two forms are thus retained as distinct species, as the available evidence makes this hypothesis more plausible than would their recognition as conspecific races.

Small Specimens of Southeastern Zaire: Some 26 specimens of Form X (*M. scalper*) have been taken in the zone around Lac Upemba, Zaire,

roughly bordered by Manono, Kilembe, Kamina, Kanonga and Munoi in Shaba (Katanga) Province, Zaire. The animals are distinct in the genus *Monopeltis* in having a partially divided head shield in adults, lacking preoculars (and sometimes also oculars), in having a short but modified pectoral region, showing caudal autotomy at the third through seventh annulus, having two precloacal pores, and low numbers of segments to a midbody annulus. This combination of characteristics clearly differentiates them from all other species. The population is parapatric with Form IX (*M. adercae*) at one locality and allopatric with all other forms of the assemblage. Since the combination of characters well distinguishes the assemblage, and no portion of its range suggests any geographical cline leading to affinity to adjacent forms, it is here considered a good species.

One difficulty arises in the sample of three specimens from Kikondja. The smallest Vienna Museum specimen excellently matches the characteristics of the rest of Form X. The second specimen and the three specimens from the Tervuren Museum (obtained in the same year by the same collector) all differ by having a large ocular and a discrete preocular in contact with the nasal. Other characteristics, such as the slightly higher 17 to 19 plus 18 instead of 13 to 17 plus 12 to 14 numbers of segments to a midbody annulus, the retention of unfused head shields in an adult, and heavy dorsal pigmentation, are only determinable on two specimens. These characteristics suggest that we may be dealing either with individuals of a distinct species or with a local race; however, as we have only four individuals, from a single locality, and Form X shows considerable other variability in ocular size and arrangement the specimens are retained *incertae sedis* with Form X.

Northern Angola and Western Zaire: Some specimens with a characteristic dumbbell-shaped keratinization of the cephalic shield (Form XI, *M. vanderysti*) are available from the dozen or so localities in western Zaire, as well as Sanza Pombo and Dundo in northern Angola. Only at Lemfu is this assemblage sympatric (or parapatric) with another *Monopeltis* (the very distinct *M. guentheri*, see Gans and Lehman, 1974). Apart from its characteristic cephalic pattern the sample shows numerous differences

from the most closely allopatric Form, X (table 6). Three specimens from Luanda, Form XII (*M. luandae*) lack the curious cephalic keratinization of Form XI. The table (6) shows Forms X and XII as sharing absence of oculo-nasal contact, and appearance of preocular segment, as well as high numbers of supernumerary dorsal half-annuli. Forms XI and XII share higher numbers of body annuli, absence of precloacal pores, larger body size, and a more anterior site for the autotomy annulus. Form X is unique in low numbers of body annuli, smaller size, and occurrence of precloacal pores, Form XI in occurrence of preoculars and keratinization pattern, as well as nasal-preocular contact and lack of supernumerary dorsal half-annuli, and Form XII in high numbers of midbody dorsals. The forms also differ in general appearance, and the wide hiatus between their apparent geographical ranges does not permit a clear decision as to whether they are truly isolated. Hence it seems most plausible to recognize Forms XI and XII provisionally as valid species.

ANALYSIS OF *DALOPHIA*

INITIAL DIVISION

The vast majority of the available records are concentrated in southwestern Zambia and northwestern Rhodesia. This region is consequently used as a starting point in the analysis of the nondimensional species (Mayr, 1946). Perhaps the two most important series of sites are those provided by Richard Japp who collected during road construction at Kalabo, western Zambia, and near Katima Mulilo, Caprivi Strip, South West Africa. As each locality furnished multiple species his efforts contributed markedly to decisions regarding validity of species. The following pattern becomes clear.

(I) A small series of specimens (*D. ellenbergeri*) restricted to western Zambia (fig. 12) was initially recognized by being quite slender and having a long tail (36-45 caudal annuli) with an autotomy site. These specimens lack a deep and wide middorsal sulcus.

(II) Another and more robust form (*D. pistillum*) is sympatric with Form I at Kalabo and Lealui, Zambia. It has a much shorter tail (19-33 caudal annuli), lacks an autotomy site, and shows

TABLE 6
Character States for Samples of *Monopeltis* from Southern Zaire and Northern Angola

	Form X *scalper*	Form XI *vanderysti*	Form XII *luandae*
Body annuli	(191) 201-225	219-241	223-227
Caudal annuli	14-18	13-17	15,16
Dorsal	13-19	18 *(20,22)* 23[a]	29 *(30,32)* 36[a]
Ventral	12-18	14-16	14-20
Anterior laterals	9	8	9 only
Preoculars	absent	present	absent
Nasal contact	absent	present - 50%	absent
Supernumerary dorsal half-annuli in:			
first 50	7-21	4	14-19
second 50	0	7	few
Pores	2	0	0
Snout-vent range	213-290	220-346	203-385
Autotomy annulus	3-7	3-5	3,4
Tail shape	Medium	Short and swollen	Medium
Autotomy segment	Slightly narrower	Markedly narrower	Slightly narrower

[a]Values in italics represent modes.

other differences such as a wide middorsal sulcus. Its range stretches from southwestern Zambia across to eastern Mozambique and south to the northern Cape Province (fig. 12).

(III) An assemblage (*D. longicauda*) from northeast South West Africa and to Wankie district, Rhodesia (fig. 12) that has a long tail (36-46 caudal annuli) but lacks an autotomy site. Specimens of this form are sympatric with Form II 15 km. westsouthwest of Katima Mulilo, and at least parapatric in Wankie National Park.

(IV) A single specimen from Sandoa in Zaire (*D. luluae*) is characterized by a very low caudal count and lack of caudal autotomy.

(V) A group of specimens from Kwango District, Zaire (*D. gigantea*), characterized by immense size and the generally complete division of the head shield, otherwise appears similar to the specimens of Form II.

(VI) Two specimens from Pungo Andongo and one from "300 miles inland from Benguella," Angola (*D. welwitschii*) lack the con-

tact between the two nasals, but have lower counts of body and caudal annuli, caudal autotomy and curious diagonal folding lines across the faint middorsal sulcus.

(VII) A group of specimens (*D. angolensis*) from eastern Angola (fig. 12) are characterized by a medium-sized tail with an autotomy site and a narrow middorsal sulcus.

DETAILS

These problems are now discussed in sequence.

Kalabo and Lealui: Japp's collection furnished 36 specimens of Form I (*D. ellenbergeri*) from Kalabo and 23 of Form II (*D. pistillum*). A second collection from Lealui (on the east bank of the Zambezi opposite Kalabo), Zambia, contains three specimens of Form I and two of Form II. Table 7 documents the numerous additional differences between these two forms and they are hence recognized as good species.
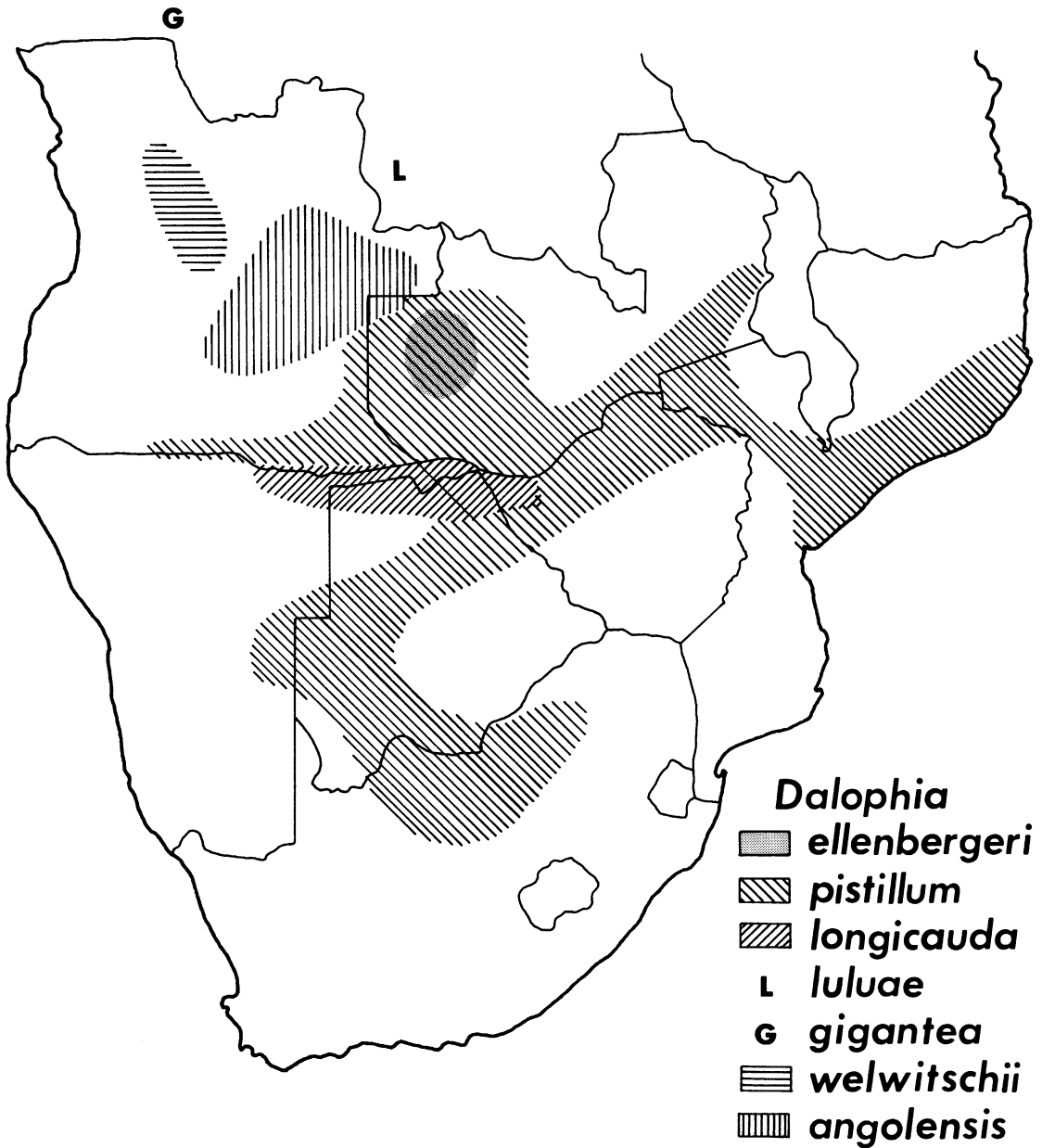
FIG. 12. *Dalophia*. Distribution of species.

One specimen of Form I from Kalabo has a much shorter tail than the remainder. This may suggest affinity to Form VII (below). However, the specimen differs from this form by its typical slender habitus, herringbone segmentation pattern, and diverse other characteristics. It also differs from the sympatric Form II by the well-marked autotomy annulus (at which the tail has been partially broken and healed) and by absence of a dorsal sulcus. The specimen is consequently

TABLE 7
Character States for Samples of *Dalophia* from Kalabo and Lealui, Zambia

	Form I (ellenbergeri)	Form II (pistillum)
Number	N=40	N=24
Ranges:		
Ventrals	212-244 ($\bar{x}$=330.8)	297-329 ($\bar{x}$=316.7)
Caudals	(30)35-45	23-27
Precloacals	6	4
Postocular	Absent	Usually present (absent in FMNH 142694 & TM 33891)
Pigmentation	Absent	Discrete, pinpoint speckling on dorsal surface, from fiftieth to 100th body annulus to tenth to twentieth caudal annulus
Frequencies: Postgenials Second row		
4	3	—
5	1	—
6	11 } 97.5%	—
7	11	1
8	13	1
9	1	4
10	—	3
11	—	6 } 92%
12	—	7
13	—	2

retained with Form I, being aberrant in only a single character.

Caprivi Strip (South West Africa): The border zone west of Katima Mulilo (Caprivi Strip) yielded a collection of specimens of Form III (*D. longicauda*) and one of Form II (*D. pistillum*). The situation in the adjacent sites in Wankie National Park (Rhodesia) suggests that the two forms are at least parapatric (fig. 13). Analysis (see also Intraspecific Variation below) suggests an extremely curious situation in that we have two "forms" that (1) differ markedly in number of caudal annuli (body plus tail length?), (2) do not show other differences, and (3) show a parallel cline in the absolute number of caudal annuli without decreasing the differences between their means (14) or their ranges (12).

The parallel drop in counts of caudal annuli suggests that these two forms might be races of a single species, but the difference between the populations is always greatest when comparison is made between adjacent populations. As decision that the two forms are races of a single species may deemphasize the problem, we here treat them as distinct species.

Zaire: There are only two samples of *Dalophia* from Zaire. The first is Form IV (*D. luluae*), represented by a single specimen from Sandoa (Lualaba), some 400 km. north of the nearest record of Form II (*D. pistillum*). The second, Form V (*D. gigantea*), is represented by the sample of four from the Kwango district, 800 km. farther to the northeast. Both samples agree with Form II in lacking a caudal autotomy

annulus, being unpigmented, and having a well-defined middorsal sulcus.

The subadult specimen from Sandoa (Form IV) is in very poor condition, but differs from Zambian specimens of Form II by having fewer caudal annuli (17 compared with 20 to 31) and fewer dorsal segments to a midbody annulus (16 compared with 17 to 23). It also lacks any trace of fusion or herringbone pattern on the dorsal surface of the tail.

The four specimens from Kwango Province (Form V) are enormous (as is the fifth at IMZUT, which was not available for this study); the smallest is longer than the largest of Form II. The series differs from all other *Dalophia* in that even the largest specimens have unfused head shields. The specimens also have preoculars, discrete pectoral patterns, and a number of caudal annuli greater than in Form IV, but near the lower end of the range of Form II.

In view of the extensive gaps between the areas from which we have samples and the substantial differences in the characteristics of these samples, it seems most appropriate to retain Forms IV and V as good species. This should certainly emphasize the existence of the variant subpopulations and may encourage the accumulation of additional specimens.

Angola: A variety of sites in eastern Angola, ranging from Alto Cuilo in the north to Caquindo in the south, yielded samples of a smallish Form VII (*D. angolensis*) characterized by 20 to 27 caudal annuli with the autotomy site at the sixth or seventh and no dorsal sulcus. As the specimens are clearly distinct from the allopatric Forms I, II, and III and show no geographic trends suggesting intermediacy of character states, they are here considered to represent a good species.

INTRASPECIFIC VARIATION

General. The following analyses group various allopatric species and document their variation across the composite range. The illustrations here shown provide a further test of the decisions in the previous section.

MONOPELTIS FORM I
(*M. capensis*)

General. Specimens of Form I are available from the Orange Free State and northern Cape Province (South Africa) in the south to Mozambique, Malawi, Zambia, and southern Angola in the north. The number of anterior lateral annuli, precloacal pores, parietals and pectorals show no trends across the range. However, four groupings (Forms A-D) could ultimately be defined on the basis of chin segmentation, pigmentation and size, as well as some other characteristics. Only Form D is considered worthy of subspecific recognition.
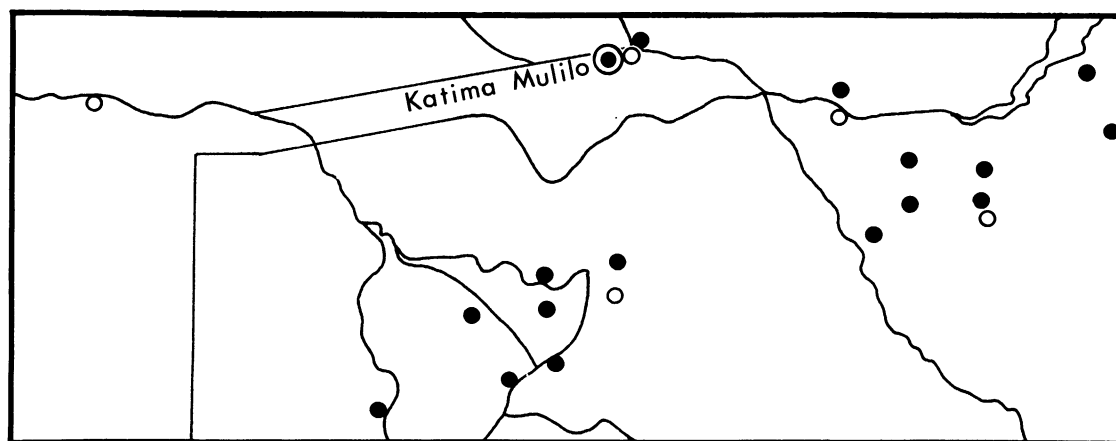

FIG. 13. *Dalophia.* Distribution of Forms II and III in the Caprivi Strip, northern Botswana, and northwestern Rhodesia. Solid dots = Form II (*D. pistillum*); open circles = Form III (*D. longicauda*).

Ventral Body Annuli. The counts of ventral body annuli are shown in figure 14. There are five areas occupied by specimens with counts more than 200. These are (1) the vicinity of Humbe, southern Angola, (2) an area extending along the Vaal and Orange rivers downstream from Bloemhof and northward into South West Africa and southwestern Botswana, (3) an area including the northern Transvaal, southeastern Rhodesia and adjoining Mozambique, (4) an isolated zone at Humani Ranch on the west bank of the Sabi River in Rhodesia and (5) a northern area extending along the Zambezi Valley downstream from Binga. It is probably significant that all these areas lie at relatively low altitudes, suggesting that the number of annuli is influenced by the temperature at which the embryo develops and that elevated temperatures correlate with higher numbers of body annuli (Fox, 1948; Vanzolini, 1968). Most other populations have means within the range 185-200.

Lateral Annuli. The populations from South Africa, excluding the northern Kruger National Park, but including southeastern Botswana (10 km. N of Matebe) and southern Mozambique, form a group with means of lateral annuli of over four (fig. 15). The specimens from northwestern Rhodesia also have means exceeding four. All other populations have means of four or less.

Caudal Annuli. Most population means of caudal annuli are within the range 7.5 to 10.0, but higher means are found in the northern Transvaal (Weipe Farm, M=10.5, R=10-11) and the southern Kruger National Park (M=9.0-10.0, R=9-11) (fig. 16). The lowest means are found in the Wankie District of Rhodesia (M=5.7-6.4, R=5-8).

Supernumerary Dorsal Half-annuli. Geographical variation in the number of supernumerary dorsal half-annuli is illustrated in figure 17. Populations in Rhodesia (excluding the Gonarezhou Game Reserve and Chipinga) and the Zambezi Valley have not more than 12, whereas all other populations have means of 10 or more. The specimens from Rhodesia may be subdivided into two groups, those from east of the Sabi River that have means of 5.5 or more and those from west of the Sabi River that have means of less than 5.5 (some intergradation occurs between the Sabi and Lundi rivers).

The lowest means are at the Humani Ranch on the west bank of the Sabi River (M=0.4, R=(−3)-4) and in Wankie District (M=0.9-2.1, R=(−1)-5). This trend toward having fewer dorsal than ventral annuli is accentuated in the sibling species *M. zambezensis.* The higher means through the rest of the species range show no clear trends.

Dorsal Segments. Variation in dorsal segments to a midbody annulus is shown in figure 18. Once again the populations from Rhodesia (excluding the Gonarezhou Game Reserve and the Zambezi Valley) are set apart from the rest by their low means of 16-22. The Binga population has an even lower mean (M=14.7, R=14-16). The only other populations with rather low means are in southern Angola (Humbe, M=22.7, R=21-26) and Waterberg District in the northern Transvaal (M=20.5-24.0, R=19-27) and southern Mozambique (M=20.0-20.8, R=17-27). Elsewhere the sample means fall with the range 22.5-28.5.

Ventral Segments. Variation in ventral segments to a midbody annulus (fig. 19) shows a similar pattern to that for dorsal segments. The lowest mean is again at Binga (M=13.2, R=12-14) and similar low counts are found elsewhere in the Zambezi Valley (but not at the eastern end of Lake Kariba) and Sengwa Gorge. Populations with means in the range 14-20 are found throughout the remainder of Rhodesia and Mozambique, also in the northern Kruger National Park (M=16.0-18.2, R=15-22) and southern Angola (M=15.3, R=14-16). The highest means are found in the central highlands of South West Africa (M=23.5-29.5, R=19-34).

Size. Snout-vent length of the four forms of *M. capensis* are charted in figure 20. Very few specimens exceed 300 mm. The largest are Form B specimens from the Orange River (Alhut 340 mm.; Aughrabies Falls 315 mm.) and South West Africa (Gocheganas 300 mm.; Otjimbingue 320 mm.; Windhoek 310 mm.).

The largest Form A specimens measured 303 mm. (Maquassi); the largest Form C specimen is from Morera, Mozambique, and measures 290 mm., being equaled in size by the largest Form D specimen from Chipangayi Bridge, Rhodesia. The overall trend is for a gradual decrease in size from southwest to northeast.
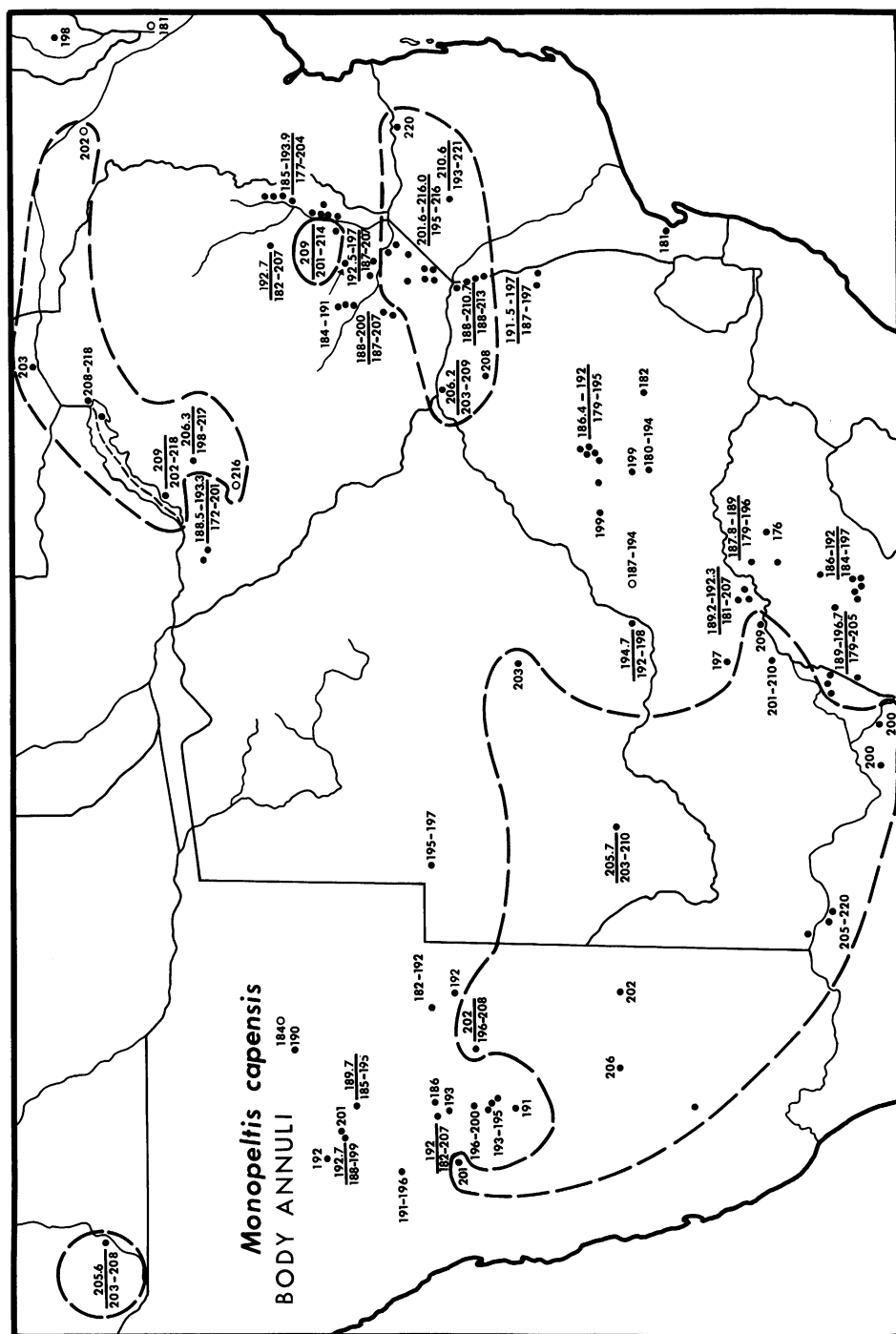
FIG. 14. *Monopeltis capensis.* Map showing the approximate variation of the number of body annuli across the geographical range. Solid dots indicate actual localities from which specimens were obtained, open circles placed in geographical center of a region indicate only the existence of specimens without more specific data rather than actual collecting localities. A single value or a range indicates that fewer than three specimens were available. When samples were larger (N > 2), values above the line give the distribution of sample means; those below indicate the range of individual values. Solid and broken lines indicate magnitude and approximate position of discontinuities in distribution of character states.

FIG. 15. *Monopeltis capensis.* Geographic variation of the number of lateral annuli. Conventions as in figure 14.

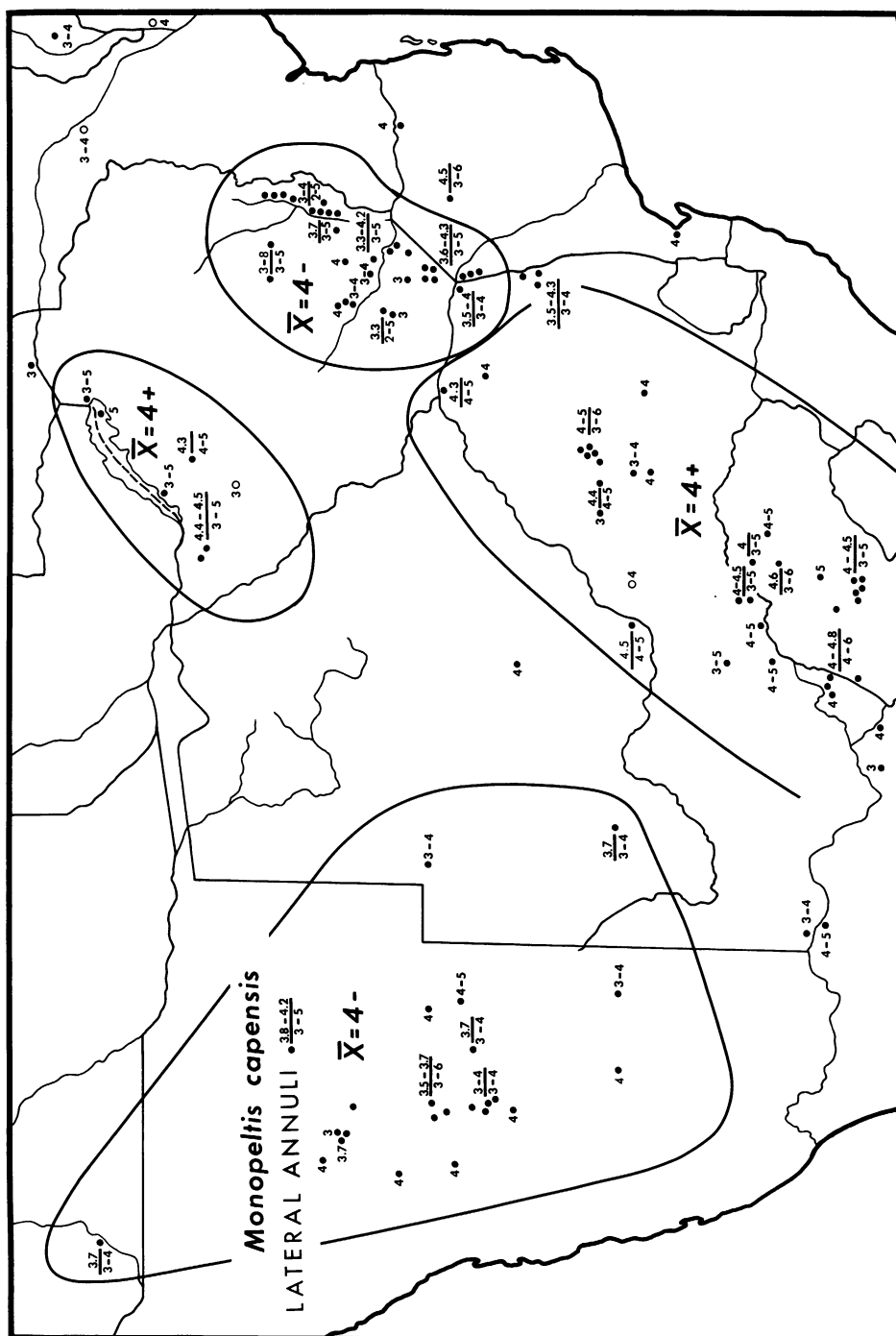FIG. 16. *Monopeltis capensis*. Geographic variation of the number of caudal annuli. Conventions as in figure 14.

FIG. 17. *Monopeltis capensis*. Geographic variation of the total number of supernumerary (intercalated) dorsal half-annuli. Conventions as in figure 14.

FIG. 18. *Monopeltis capensis*. Geographic variation of the number of dorsal segments to a midbody annulus. Conventions as in figure 14.
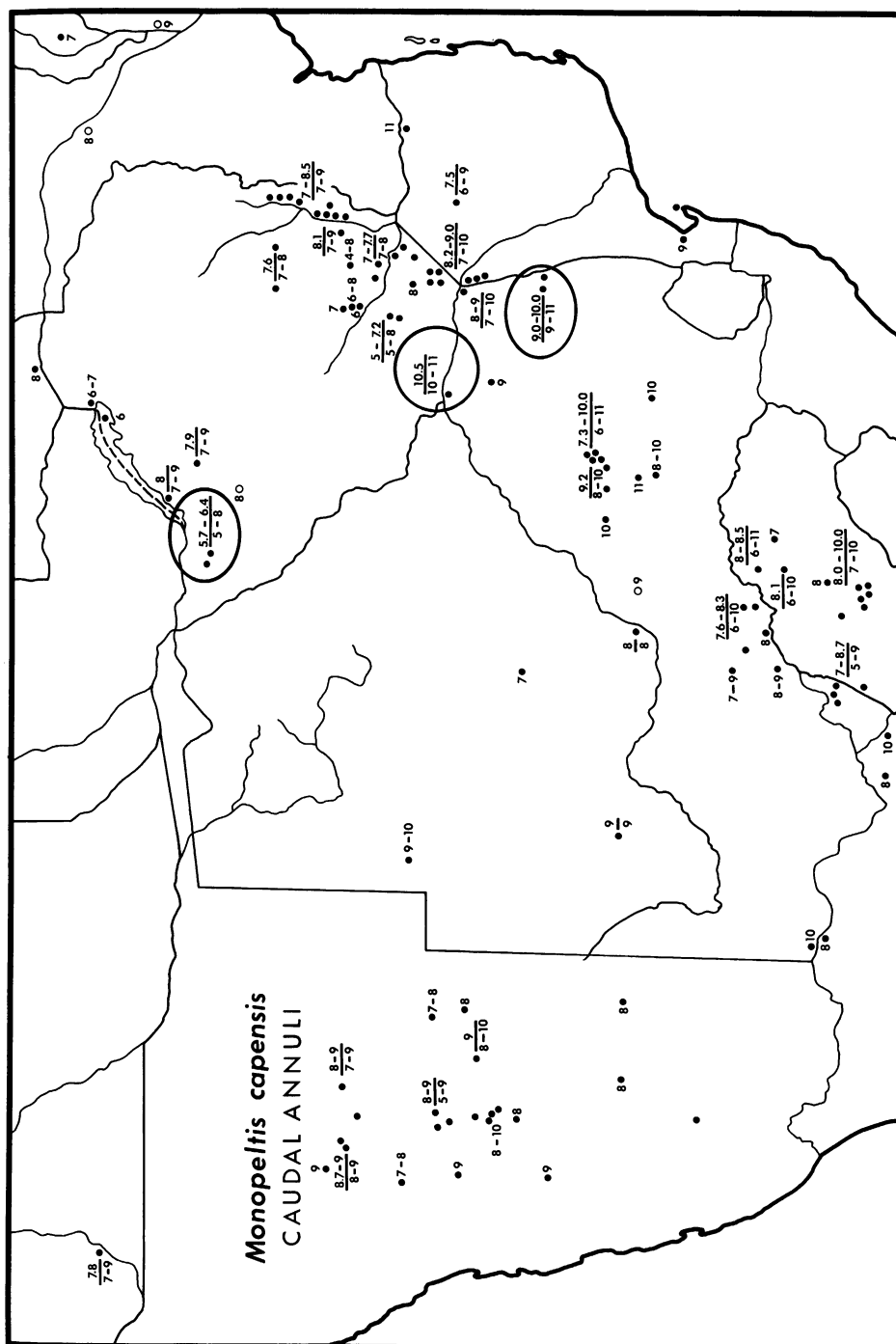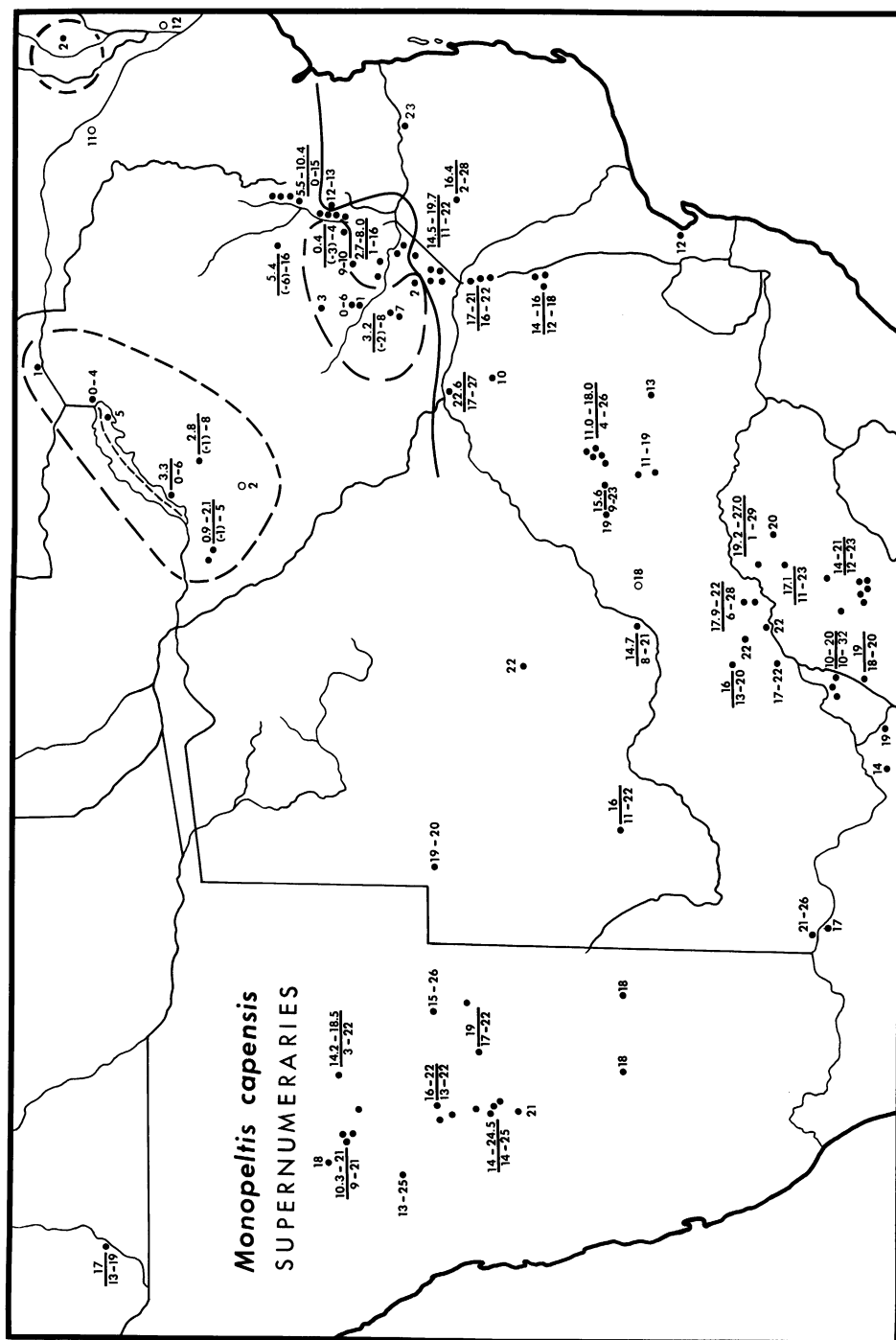
FIG. 19. *Monopeltis capensis*. Geographic variation of the number of ventral segments to a midbody annulus. Conventions as in figure 14.
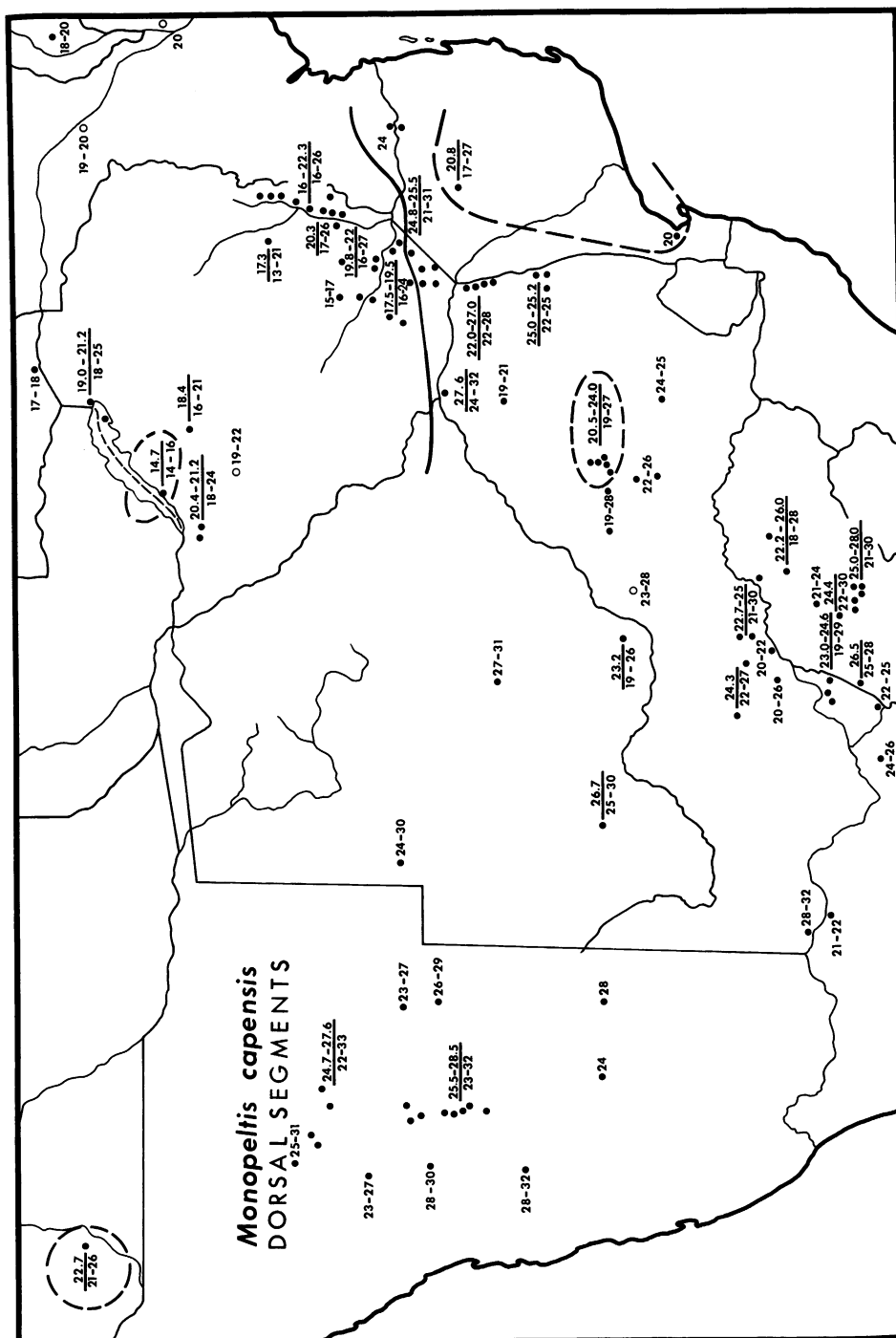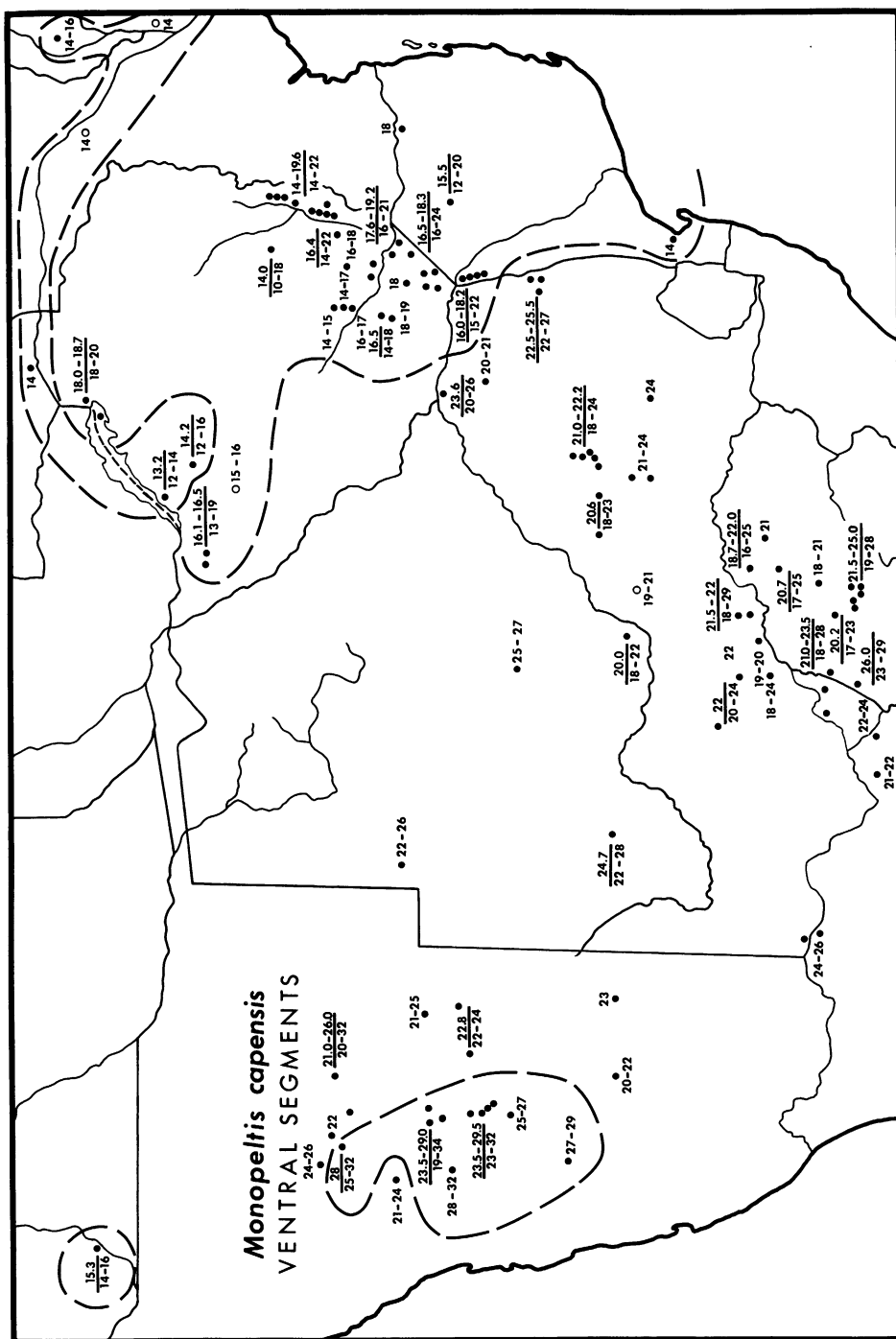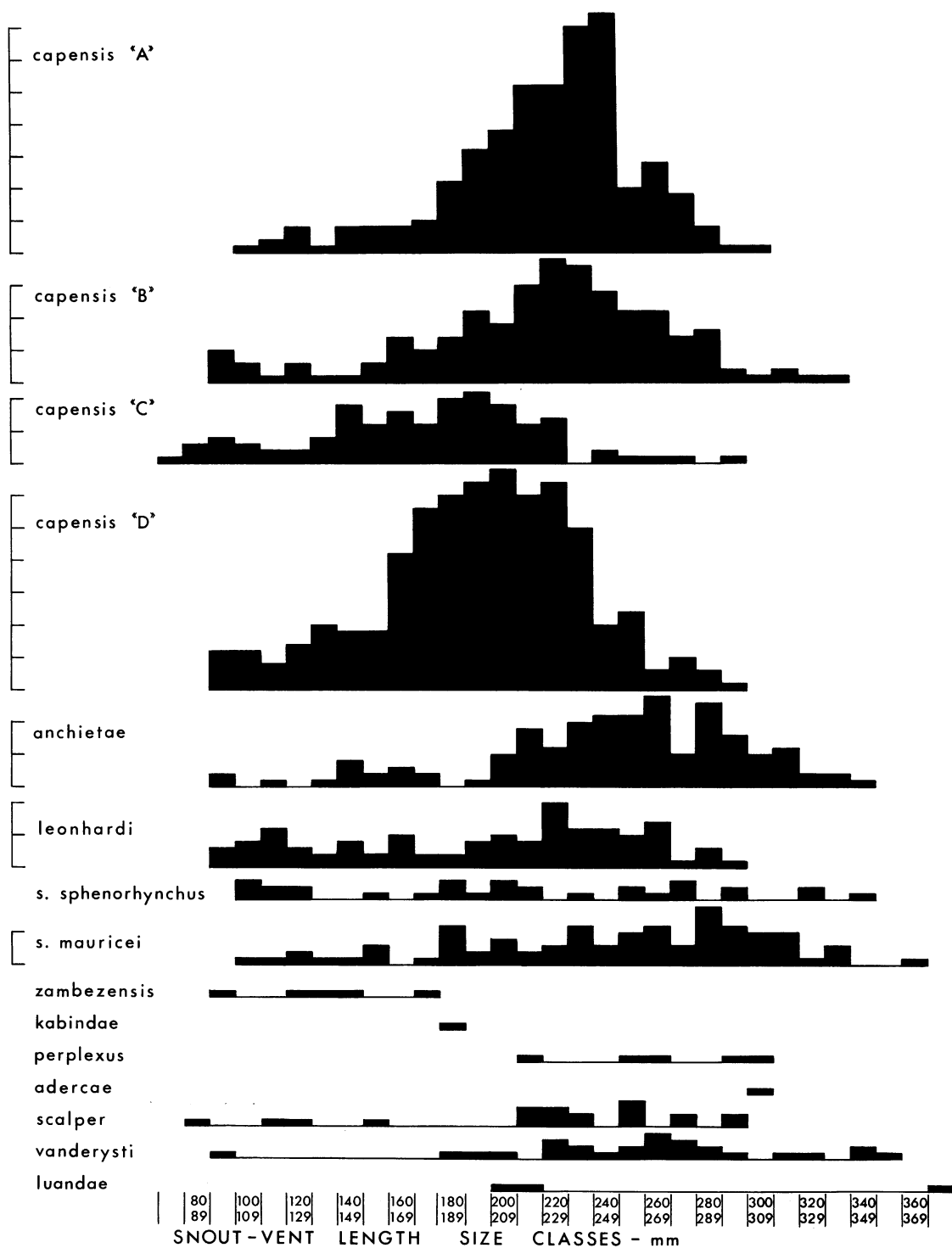
FIG. 20. *Monopeltis.* Histogram for snout-vent lengths of various species of the genus, as well as the four forms of *M. capensis.* Divisions on the vertical (frequency) scale indicate five specimens.

Labial Scales. The specimens from southeastern Rhodesia (excluding the Gonarezhou Game Reserve) tend to have a reduced number of labial scales. As one proceeds southward from Umtali there is a rapid rise in the percentage of specimens with only two upper and/or lower labials, while there is a similar rise in the proportion of specimens in which the nasals reach the lip.

First row of Postgenial Scales. Populations in the Orange Free State (except Brandfort and Krugersdrif Dam), Kimberley area, southwestern Transvaal and southeastern Botswana (Form A) have lower numbers (means of 2-3) of scales in the first postgenial row than specimens from outside this area (means 3-4). Exceptions are the population at Humbe in southern Angola and the type of *M. decosteri* from south Mozambique, which all have two postgenials in the first row (fig. 21).

Second row of Postgenial Scales. The Rhodesian specimens (and those from northern Kruger National Park) are set off from other material in having means of 4-7 for the second postgenial row (fig. 22). The lowest means are in Wankie District (M=4.6-4.7, R=2-9). Outside Rhodesia, the means are within the range of 7-9, except for one group from the northern Orange Free State (Odendaalsrus, Kroonstad, and Bothaville) that has means similar to those found in Rhodesia.

Head Shield Pattern. Type 1 head shields are found in 81 percent of Rhodesian (Form D) specimens and in 29 percent of the Form C specimens from the Gonarezhou Game Reserve, northern Kruger National Park and adjoining Mozambique. The type 2 head shield pattern is found in 82 percent of Form A specimens from the region centered on the Orange Free State, but is less common in Forms B (45%), C (71%), and D (11.5%). Type 3 head shields are common in Form B specimens (42%) and occur in 15 percent of Form A specimens, but are rare in Form D specimens (7.5%, restricted to northwestern Rhodesia and Humani Ranch) and not found in Form C specimens.

Divided (type 4) head shields are found in 11 percent of Form B specimens; 11 of these originate from South West Africa and six from the northern Transvaal. The only Form A speci-

men with a divided head shield comes from Rooidam, Kimberley District. No type 4 head shields have been found in Form C or D material.

Pigmentation Pattern. Form A ("typical" *capensis*) populations are characterized by their lack of pigmentation (pattern D) and inhabit the Orange Free State, Kimberley District, southwestern Transvaal, and southeastern Botswana. Specimens from Mozambique, the northern Kruger National Park and a few Rhodesian localities also exhibit pattern D in fresh material, but some of the unpigmented specimens from other areas may have been bleached following preservation.

Patterns B and C predominate in the Form B populations extending from South West Africa east to the Kruger National Park, but occasional specimens show A and D patterns.

Form C populations in the Gonarezhou Game Reserve, Rhodesia, are variable, exhibiting patterns C, D, and F, whereas those from Matchova, Mozambique, are all pattern F. Form D populations in Rhodesia all show pattern C, except for a few pattern B specimens from Birchenough Bridge, some pattern E specimens from Nyashanu, and C and D specimens from Kariba Lake.

Summary of Geographic Variation. Monopeltis Form I (*capensis*) has a wide range and is represented by far more specimens than any other species of *Monopeltis* or *Dalophia*. It is therefore convenient informally to subdivide Form I for purposes of discussion (table 8). The most clearly defined group (Form D = *M. c. rhodesianus*) consists of material from Rhodesia and adjoining territories with relatively few supernumerary dorsal half-annuli (usually fewer than 12), few segments in a midbody annulus, ocular very small or absent and tail more heavily pigmented than body. The populations in the Orange Free State, southwestern Transvaal, northeastern Cape Province, and extreme southeastern Botswana (Form A) are distinguished by a complete lack of pigmentation and by usually having two or three anterior postgenials. A series of populations extending from southern Angola through South West Africa, southern Botswana, and northern Cape Province to the eastern Transvaal (Form B) is usually distinguishable by its relatively heavy pigmentation and a high propor-

TABLE 8

Character States for the *Monopeltis capensis* Group and *Monopeltis zambezenis*

Number		Form "A" N=239	Form "B" N=170	Form "C" N=196	Form "D" N=349	zambezensis N=6
Ranges:						
Ventral annuli		176-210	179-220	185-221	172-218	226-263
Lateral annuli		3-6	3-6	3-5	3-5	3-5
Caudal annuli		5-11	4-11	6-11	5-9	7-8
Extra dorsal half-annuli		(1) 6 to 32	3 to 27	(2) 9 to 28	−6 to +16	−7 to −1
Midbody segments						
dorsal		18-30	10-33	17-31	13-26	18-20
ventral		16-29	14-32	12-23	10-22	14-16
Frequencies:						
Laterals	2	−	−	−	2	−
	3	10	38	29½	109½	1
	4	143	102	90½	182½	3½
	5	73	22	34	22½	½
	6	8½	3	−	½	−
Caudals	4	−	1	−	2	−
	5	1	1	−	7	−
	6	7	4	6	18	−
	7	30	20	38	100	1
	8	123	52	71	161	5
	9	61	52	35	33	−
	10	12	28	5	−	−
	11	1	8	1	−	−
Postgenials						
First row	2	167 } 86%	15	50	4	−
	3	39 }	17	25	16	1
	4	29	131 } 79%	117 =61%	325 =94%	5 =83%
	5	3	4 }			
Second row	2	−	−	−	1	−
	3	−	−	−	17	−
	4	1	1	14	52 } 86%	4
	5	25	9	123 } 87%	131	1 } 100%
	6	53	25	30 }	96	1
	7	93	59	22	37	−
	8	39	44	2	8	−
	9	15 } 66%	14 } 79%	−	3	−
	10	5	9	−	1	−
	11	2	1	−	−	−
Upper labials	1	−	−	−	½	−
	2	1	2½	5½	106	−
	3	230	158½	188½	240½	6
	4	5½	5	1	2	−
	5	½	−	−	−	−
Lower labials	2	16½	4½	6	72	−
	3	216½	157½	189	272	6
	4	4	3	−	−	−

TABLE 8 – (Continued)

Number		Form "A" N=239	Form "B" N=170	Form "C" N=196	Form "D" N=349	zambezensis N=6
Frequencies:						
Head Shield Type	1	7 ⎱ 85%	4	28 ⎱ 100%	285 ⎱ 93%	–
	2	196 ⎰	75	167 ⎰	39 ⎰	2
	3	34	70 ⎱ 52.5%	–	25	4 ⎱ =67%
	4	1	16 ⎰	–	–	–

tion of specimens with the head shield transversely divided (in juveniles) or with lateral clefts (in adults). In the northern portion of the Kruger National Park, southeastern Rhodesia and adjoining Mozambique a group of populations (Form C) are somewhat intermediate between Form B (with which they agree in having numerous dorsal half-annuli and segments in a midbody annulus) and Form D (with which they agree in having reduced pigmentation and an individual head shield). Of these four groups, only Form D is here given subspecific status.

MONOPELTIS FORMS II, III
(M. anchietae, M. leonhardi)

General. Specimens of Form II are available from southern Angola, northern South West Africa (including the Caprivi Strip), and northern Botswana; whereas specimens of Form III originate from central South West Africa, Botswana, and western and southeastern Rhodesia.

Ventral Body Annuli. Most sample means for body annuli (counted along the ventral surface) fall within the range 175-185 for both species (fig. 23) but the two *M. leonhardi* from Bethanie, South West Africa, have 211-213 and the isolated easternmost *M. leonhardi* specimen from Malugwe Pan, southeastern Rhodesia, has 192. Wherever the two forms are sympatric, *M. leonhardi* has a higher count than *M. anchietae*. At Okahandja 10 *M. anchietae* have M=179.7, R=177-182, compared with three *M. leonhardi* that have M=186.7, R=177-194. At Kalidona one *M. anchietae* has 179, compared with 195 for one *M. leonhardi*. At Otjosongombe two *M. anchietae* have 180 or 181 and one *M. leonhardi* has 186. At Otjorondyupa four *M. anchietae* have 175-183 and one *M. leonhardi* has 184. Two
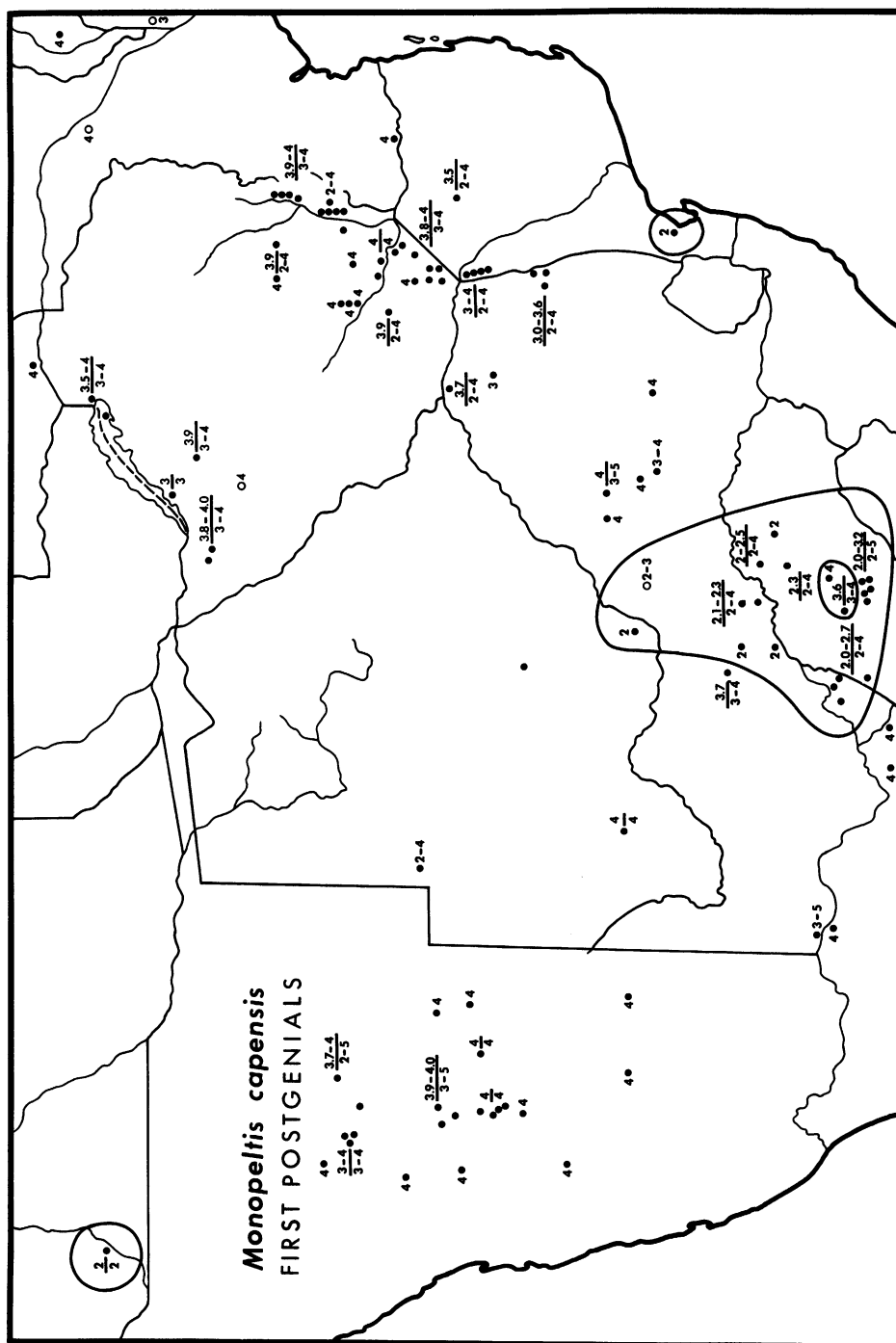
Waterberg specimens of *M. anchietae* have 180, 181 and 10 *M. leonhardi* have M=184.5, R=181-191.
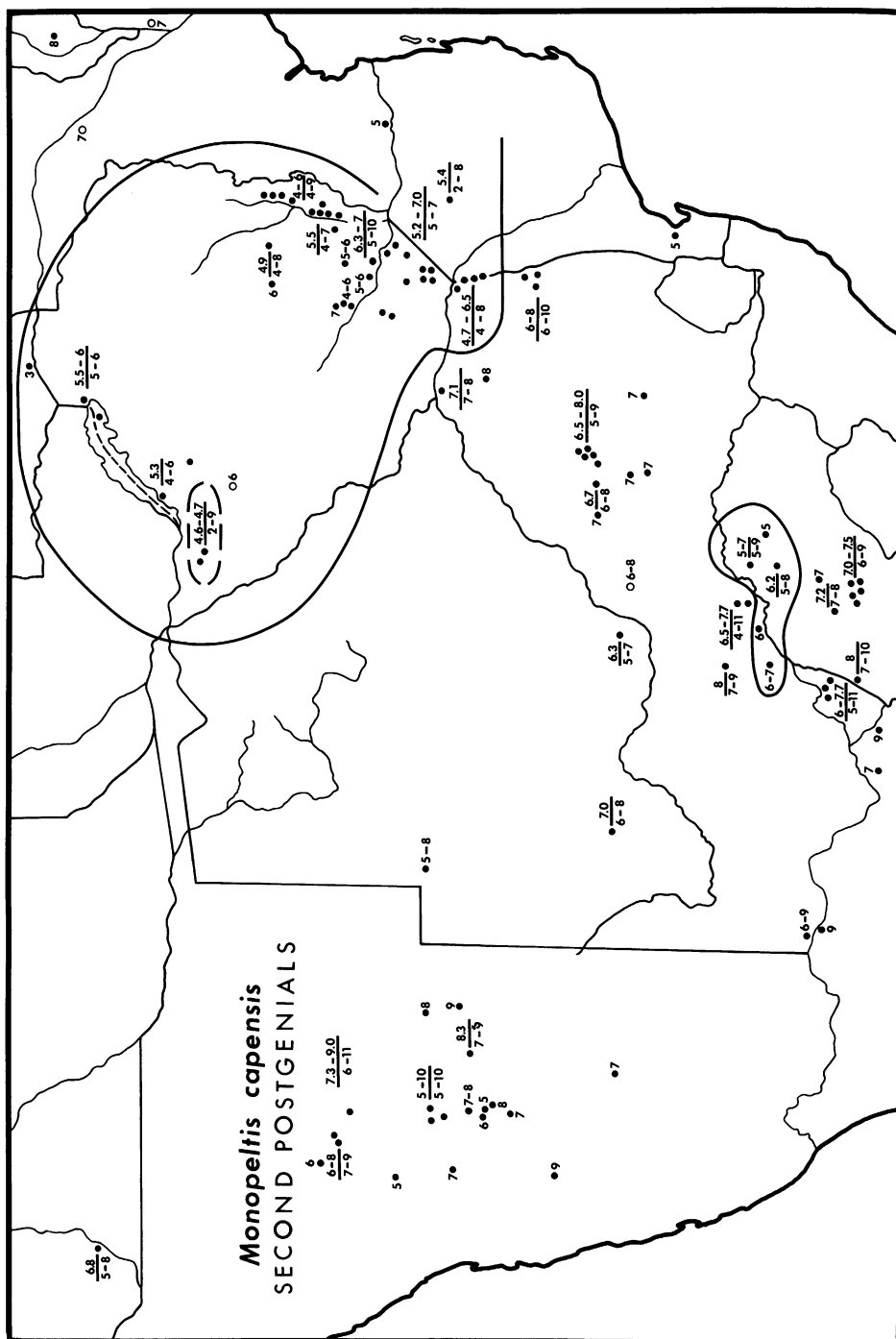
Lateral Annuli. The two species are usually readily separated by lateral annuli count (fig. 24), normally 5-7 in *M. anchietae* and 3-4 in *M. leonhardi*. The distinction is less clear at Okahandja, where the 10 *M. anchietae* have M=5.5, R=5-6, and the three *M. leonhardi* have M=4.8, R=4-7.

Caudal Annuli. The specimens from the eastern Caprivi Strip (*M. anchietae*) and those from southwest Botswana (*M. leonhardi*) are similar in having lower means of caudal annuli (under seven) than the rest of the specimens.

Supernumerary Dorsal Half-annuli. Figure 25 shows that in *M. anchietae* the sample means of supernumerary dorsal half-annuli increase from west (Okahandja, M=12.2, R=6-20) to east (eastern Caprivi, M=19.4-20.5, R=9-28), whereas in *M. leonhardi* they decrease from the west (Okahandja, M=16, R=13-18; Waterberg, M=16.4, R=12-22) toward the southeast (southwest Botswana, M=10.7-14, R=8-18) and northeast (Wankie District, M=11.0-15.7, R=8-16). Consequently at the South West African localities where the two species are sympatric, the specimens of *M. leonhardi* invariably have higher mean counts than that in associated specimens of *M. anchietae*.

Dorsal Segments. The variation in the number of dorsal segments to a midbody annulus in the two species is shown in figure 26. Little variation is found in *M. anchietae*, with sample means within the range 21-24 (28, 29 in the Otjovasandu specimen). In *M. leonhardi* the highest counts are in the west (Okahandja, M=27.3, R=22-34) and northeast (Wankie District, M=23.9-24.6, R=21-27), with the lowest ones in the south (southeast Botswana,

FIG. 21. *Monopeltis capensis*. Geographic variation of the number of segments to the first postgenial row. Conventions as in figure 14.

FIG. 22. *Monopeltis capensis*. Geographic variation of the number of segments to the second postgenial row. Conventions as in figure 14.
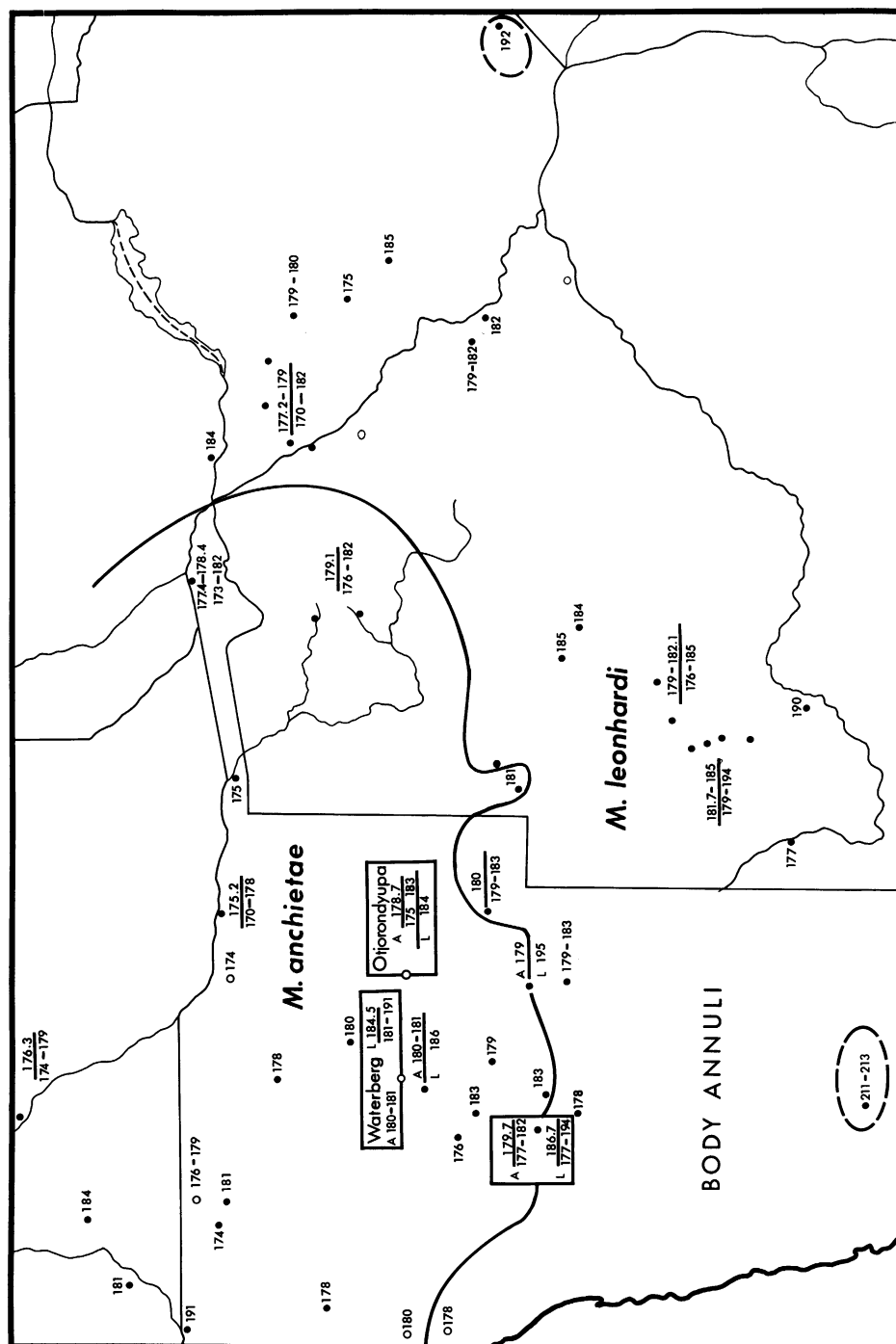
FIG. 23. *Monopeltis anchietae* and *M. leonhardi*. Map showing approximate variation of number of body annuli across the geographical range. Boxes indicate data for samples of both forms (identified by the letters A and L) from single localities. All other conventions as in figure 14.
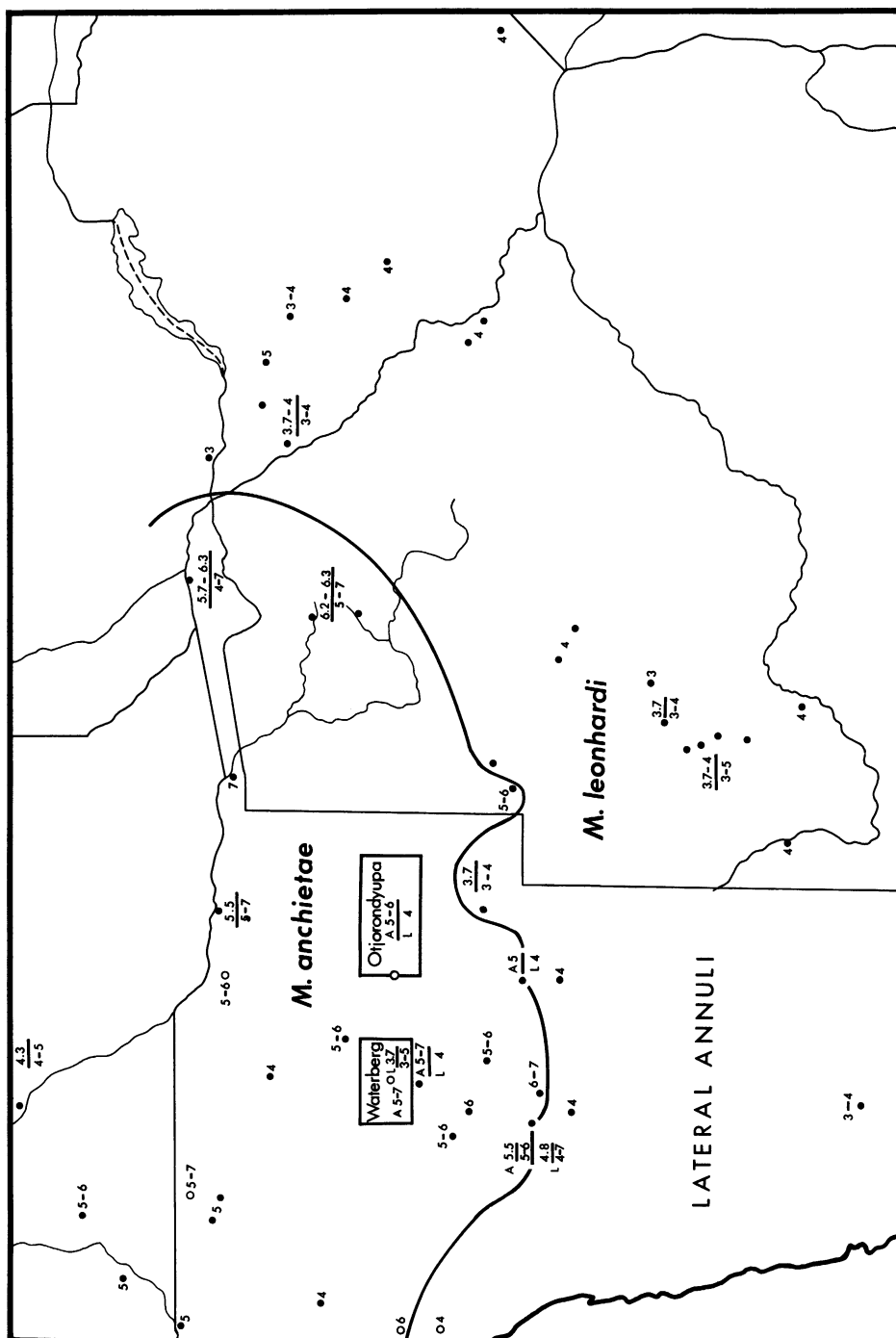
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FIG. 24. *Monopeltis anchietae* and *M. leonhardi*. Geographic variation of the number of lateral annuli. Conventions as in figure 23.

FIG. 25. *Monopeltis anchietae* and *M. leonhardi:* Geographic variation of the total number of supernumerary (intercalated) dorsal half-annuli. Conventions as in figure 23.
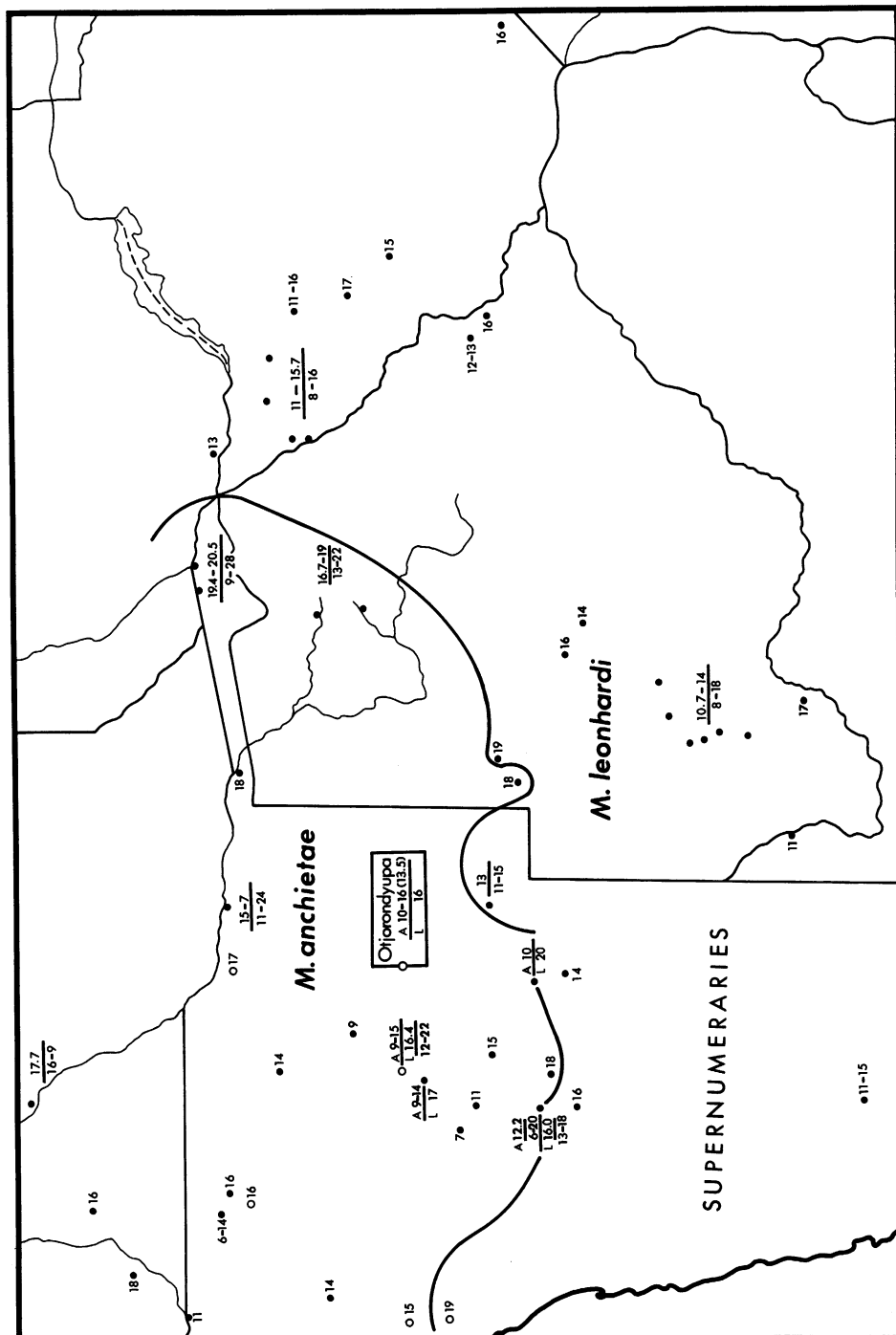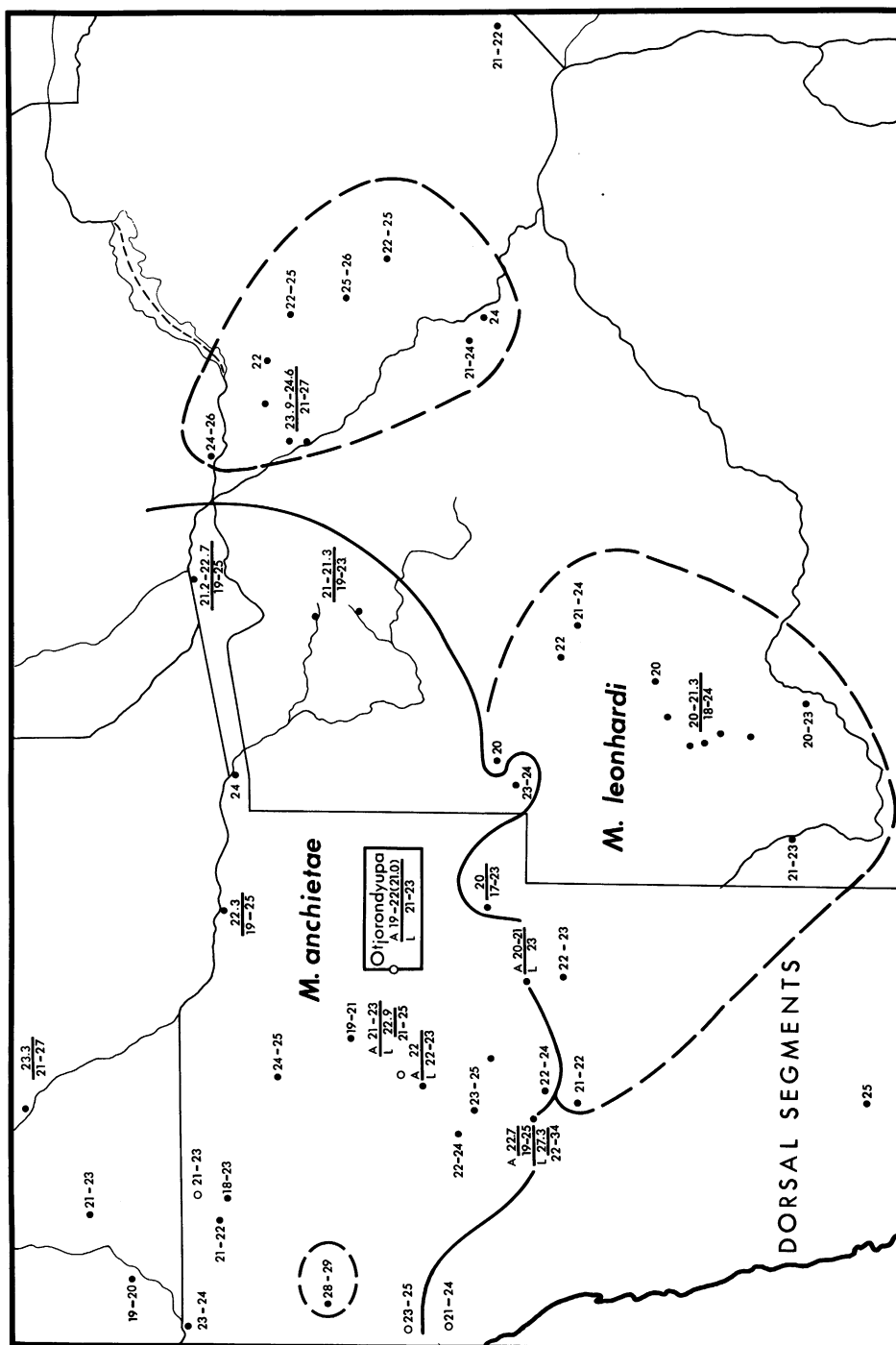
FIG. 26. *Monopeltis anchietae* and *M. leonhardi*. Geographic variation of the number of dorsal segments to a midbody annulus. Conventions as in figure 23.

M=20.0-21.3, R=18-24). Where the two species are sympatric *M. leonhardi* always has the higher mean count.

Ventral Segments. The geographical variation in the number of ventral segments to a midbody annulus of these two species is illustrated in figure 27. In *M. anchietae* the lowest means are in the east (eastern Caprivi and eastern Okavango, M=15.5-15.8, R=14-18), increasing westward (24-27 in the Otjovasandu specimen). Nevertheless, at the five western localities where *M. anchietae* is sympatric with *M. leonhardi*, the latter species invariably has the higher mean, the minimum difference being at Okahandja (*M. anchietae*, M=17.0, R=15-18; *M. leonhardi*, M=18.2, R=15-27). In *M. leonhardi* the lowest counts are in southwestern Botswana (M=16.4-18.7, R=16-20) and southeastern Rhodesia (Malugwe Pan specimen 14, 15), with the highest in the Wankie District of Rhodesia (M=19.2-20.0, R=18-22).

Size. Histograms of snout-vent length for these species are included in figure 20. *Monopeltis anchietae* averages larger and its largest specimen (345 mm., 15 km. WSW of Katima Mulilo) considerably exceeds the largest *M. leonhardi* (290 mm., Malugwe Pan).

Precloacal Pores. Two pores are found in all specimens of *M. anchietae* except those from the northernmost localities in Angola (type of *M. anchietae* and cotypes of *M. okavangensis*), which lack pores. Pores are never present in *M. leonhardi*.

Second row of Postgenial Scales. No clear trends are apparent in the number of postgenial scales shown by either species; adjacent populations often have very divergent means.

Head Shield Pattern. In *M. anchietae* a great deal of variation is observed in the second occipital from each side, with the situation more pronounced on the left. Examples are splitting of the segment to form an anterior "postocular," splitting twice to form a postocular and two occipitals, and formation of a triangular segment that does not contact the posterior edge of the occipital row. No geographical variation seems to exist in this characteristic.

In *M. anchietae* there are usually eight or 10 parietals (R=6-13), whereas in *M. leonhardi* there are usually six (R=4-7). There is no geographical variation in either species (fig. 28).

Pigmentation Pattern. The vast majority of specimens are Pattern A, with only scattered specimens exhibiting other patterns. These aberrant specimens are probably the result of fading.

Pectorals. There are normally four pectorals in *M. anchietae* and six in *M. leonhardi*. Exceptions are rare (fig. 29): only two *M. anchietae* have six pectorals (one being a cotype of *M. okavangensis*) and only three *M. leonhardi* have four pectorals (all are from Botswana).

Summary of Geographical Variation. None of the variation suggests anything more than the occurrence of two species with only slightly overlapping ranges. Although the character states generally seem more distinct in localities where both have been taken, the representation is inadequate to claim character displacement.

MONOPELTIS FORM IV
(*M. sphenorhynchus*)

General. Specimens of Form IV are available from northeastern South West Africa (including the Caprivi Strip), Botswana, northwestern Rhodesia, northern Cape Province, northern Transvaal, and southern Mozambique. The number of caudal annuli, second row postgenials, parietals, and pectorals shows no trends across the range.

Anterior Lateral Annuli. Most populations have means of anterior lateral annuli between nine and 10. The highest sample mean is 10.2 (R=9-11) for 55 km. S of Tshane, Botswana; the lowest is 8.8 (R=8-10) for the long series from Katima Mulilo, eastern Caprivi Strip.

Ventral Body Annuli. Geographical variation in ventral body annuli is shown in figure 30. Interpretation is complicated by the wide variation (228-280) in the three specimens from Inhambane, Mozambique, including the holotype of *M. sphenorhynchus*, which has the lowest count. Otherwise the lowest counts are found in specimens from northwestern Transvaal (234-240), followed by somewhat higher counts (248-284) in northeastern Transvaal and Mapinhane, Mozambique, whereas the highest counts for eastern *M. s. sphenorhynchus* are for the southernmost localities Manhica and Lourenco Marques (M=271.4, R=256-283). In the western race *M. s. mauricei*, the total range of variation is almost spanned by the long series from the

FIG. 27. *Monopeltis anchietae* and *M. leonhardi*. Geographic variation of the number of ventral segments to a midbody annulus. Conventions as in figure 23.

FIG. 28. *Monopeltis anchietae* and *M. leonhardi*. Geographic variation of the number of segments in the parietal row. See figure 10 for details. Conventions as in figure 23.
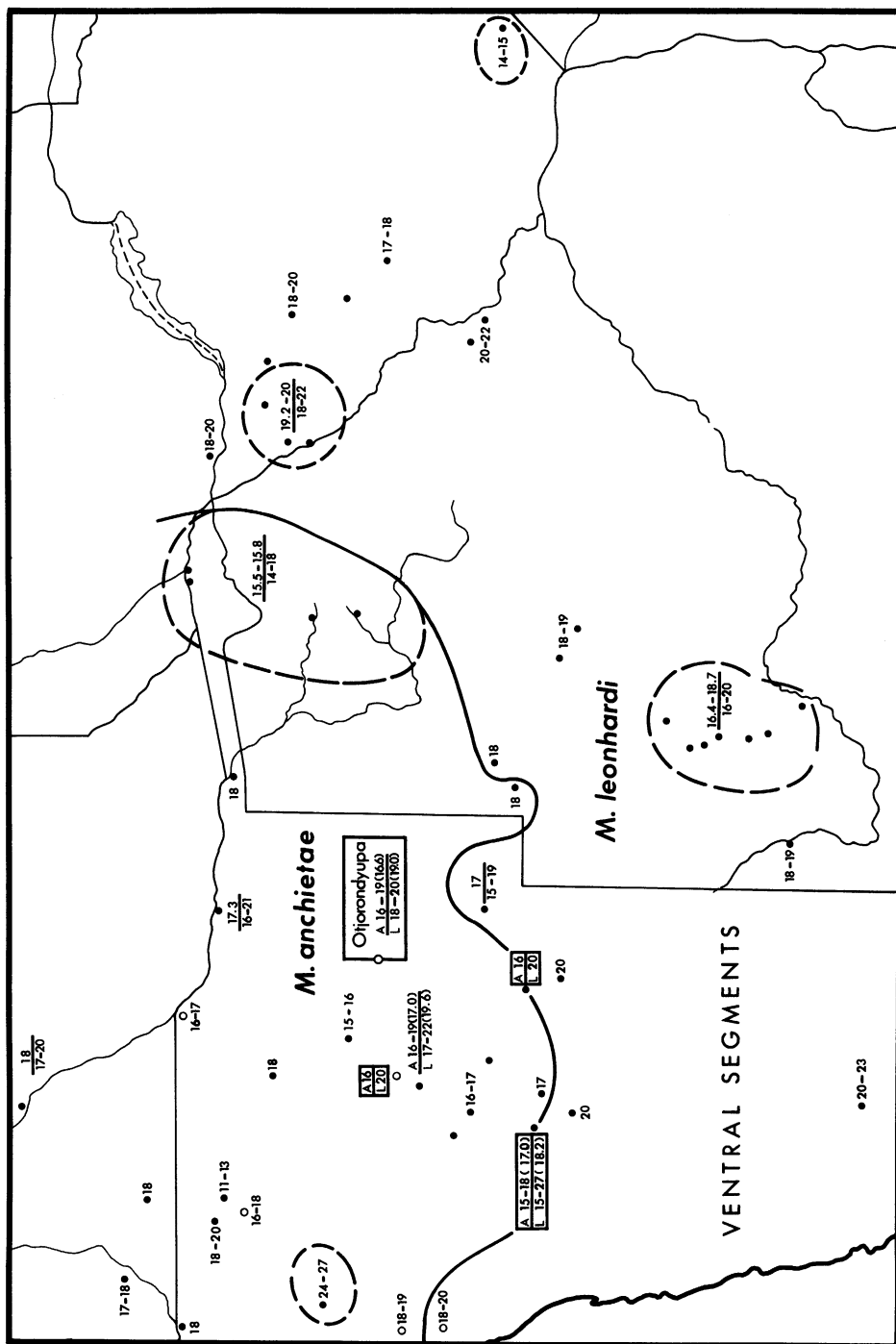
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FIG. 29. *Monopeltis anchietae* and *M. leonhardi*. Geographic variation of the number of enlarged pectoral shields. See conventions as in figure 23.

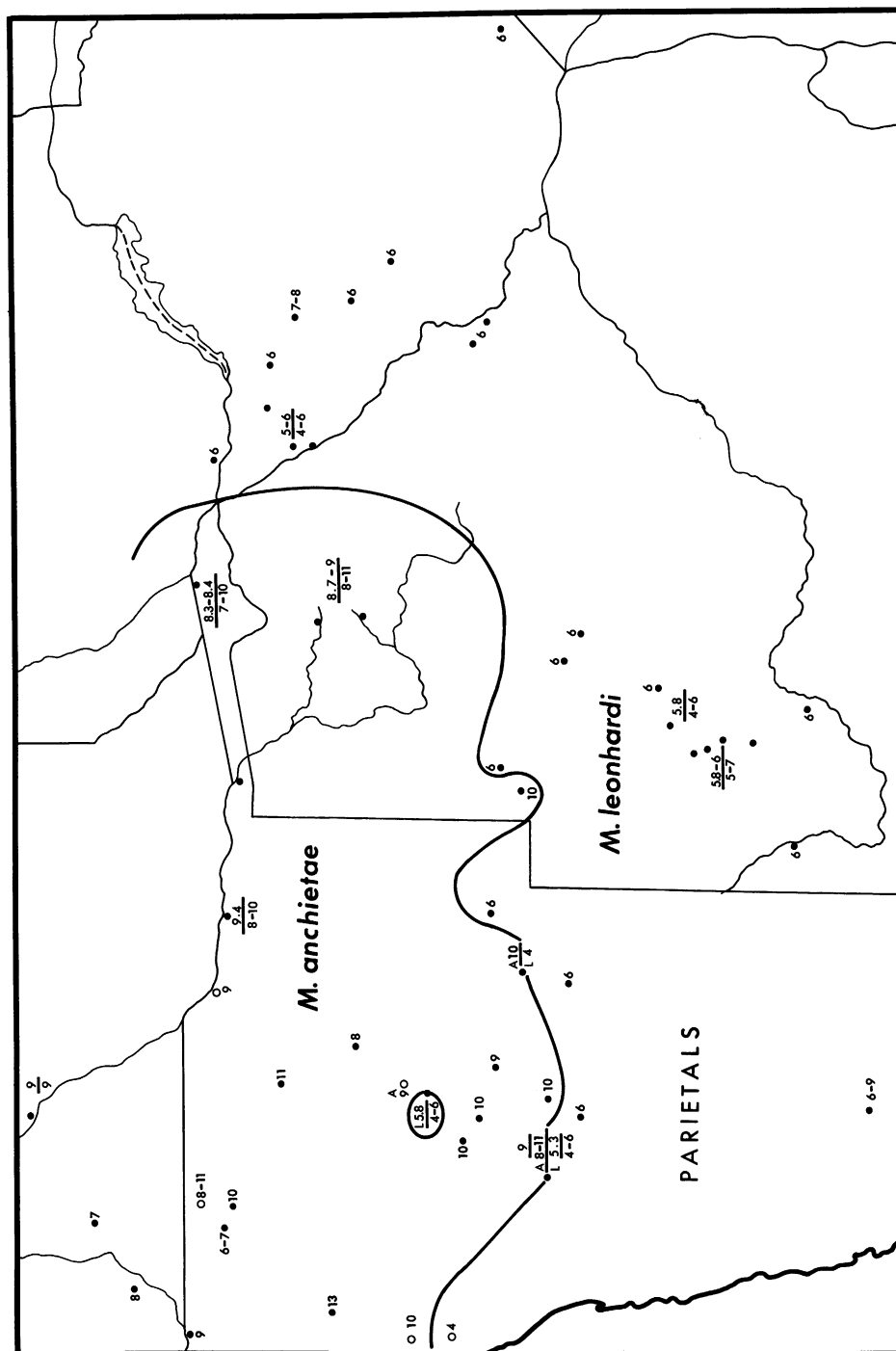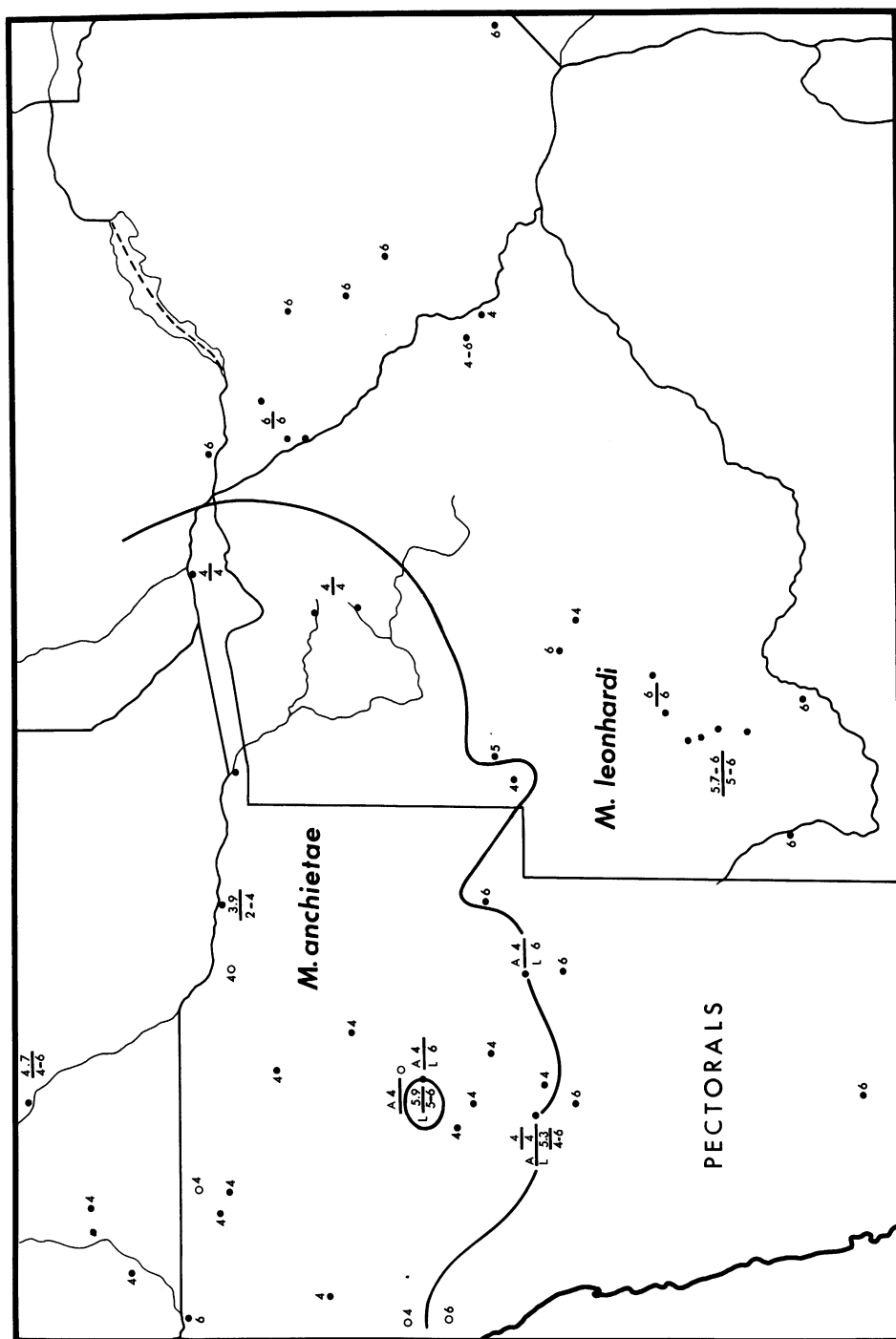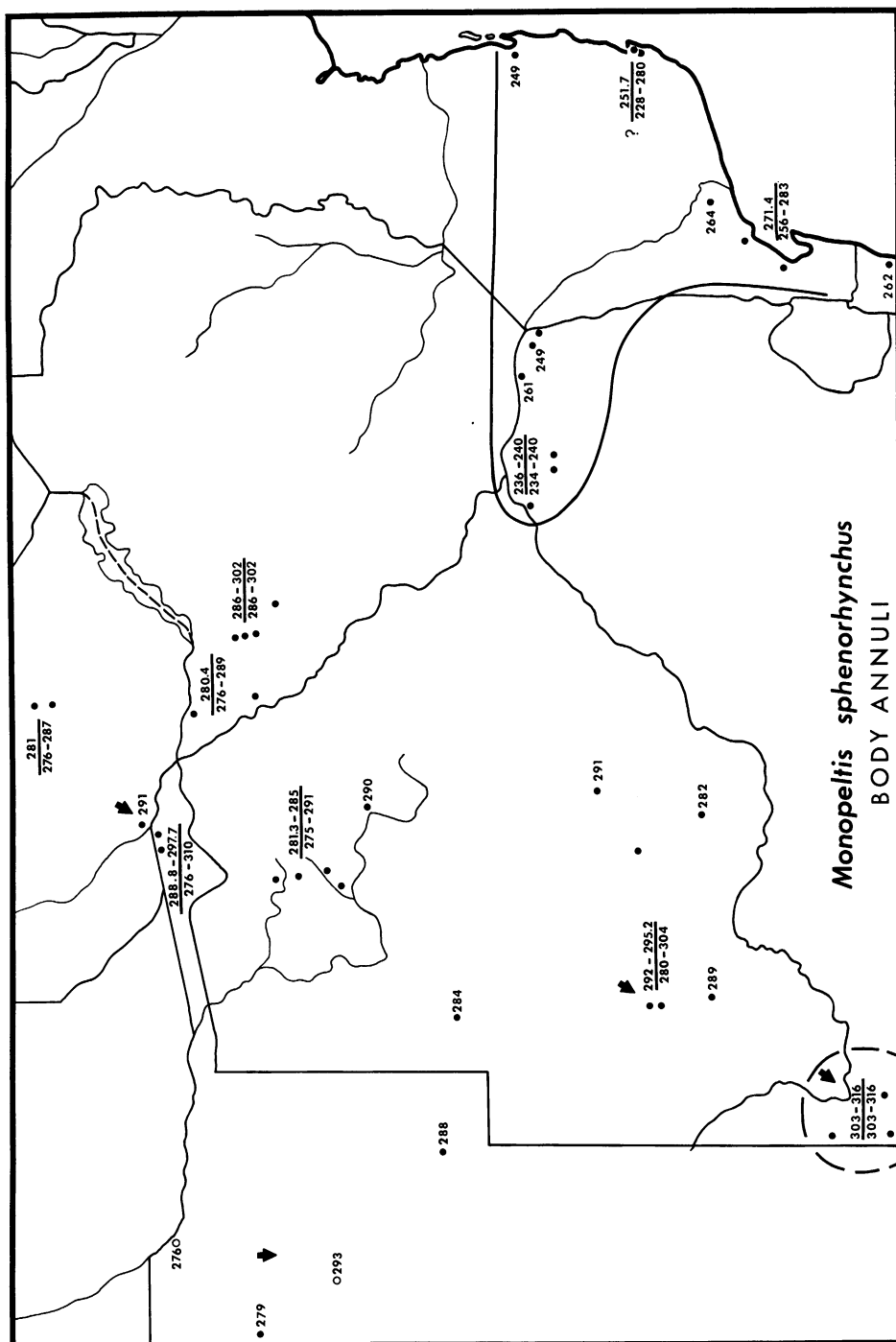FIG. 30. *Monopeltis sphenorhynchus.* Map showing approximate variation of the number of body annuli across the geographical range. Conventions as in figure 14.

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eastern Caprivi Strip (M=288.8-297.7, R=276-310), but this region is surrounded by somewhat lower counts in the Kafue National Park (M=281.0, R=276-287), Victoria Falls (M=280.4, R=276-289) and the eastern Okavango (M=281.3-285, R=275-291). The highest counts are from the southernmost localities in Gordonia District (R=303-316).

Lateral Annuli. Although the mean numbers (5.0-5.3) of lateral annuli appear to be slightly higher in the eastern Caprivi Strip and northern Botswana, this may be an illusion caused by the small number of specimens collected elsewhere.

Supernumerary Dorsal Half-annuli. Most of the specimens have a very low number of supernumerary dorsal half-annuli and, in fact, many of them have negative numbers. A single specimen from Khutse Game Reserve, Botswana, has 16—the highest figure recorded. At the other extreme are the specimen "Sicumba" with nine fewer dorsal than ventral annuli and others from southwestern Botswana and Gordonia District with six. No geographical trends are apparent.

Dorsal Segments. Geographical variation of dorsal segment numbers is shown in figure 31. The western *M. sphenorhynchus* localities all have means of 35 to 41 except for some localities in southwestern Zambia and northwestern Rhodesia, which have means of 32-34. The eastern *M. sphenorhynchus* populations in the northwestern Transvaal (including the type of *gazei*) also have means in the range of 32-34; moving eastward into Kruger National Park and Mozambique (Mapinhane south to Chimonzo) the means drop to 25.5-27, but rise again to 29.8-30.2 in southern Mozambique (Manhica and Lourenco Marques), and 33.5 in the only Tongaland specimen.

Ventral Segments. Again western *M. sphenorhynchus* have sample means of ventral segments in the range 19.5-27.0, which are generally higher than those of the eastern race (fig. 32). The northern Transvaal populations have M=19.0-22.5, but the Mozambique populations have M=16.8-19.6, rising to 23.5 in the Tongaland specimen.

Size. The histograms in figure 20 do not indicate any average size difference between the races. The largest specimen is from Maun, Botswana (365 mm.), but the next largest is an eastern *M. sphenorhynchus* from Mapinhane, Mozambique (345 mm.).

Labial Scales. Four upper labials are present in two specimens from the eastern Caprivi Strip; reduction to two upper labials occurs in half the northern Transvaal specimens.

Two lower labials are found in the types of *M. sphenorhynchus* from Inhambane, Mozambique, also in the Mapinhane specimen, one Waterpoort specimen, and also the single specimen of *M. s. mauricei* from Khutse Game Reserve.

First row of Postgenial Scales. All specimens have two postgenial scales in the first row, apart from a solitary specimen from "western Okavango" with four.

Head Shield Pattern. Adults of this species usually have type 1 head shields, although type 2 occurs in the northern Transvaal populations. Five juveniles (snout-vent length 105-180 mm.) have type 4 head shields and 15 specimens (snout-vent length 115-265 mm.) have type 3 head shields. There is obviously ontogenetic variation in this character, similar to that described for *Monopeltis guentheri* by Gans and Latifi (1971). However, it should be noted that a juvenile specimen of 124 mm. snout-vent length from Dikomu-di-Kai already has a type 1 head shield.

Pigmentation Pattern. Most populations of western *M. sphenorhynchus* have pattern E, but unpigmented (pattern D) specimens occur in the Gordonia District, southern Botswana, northern South West Africa, and Sesheke, Zambia. Pattern E occurs in eastern *M. sphenorhynchus* from the northern Transvaal, whereas Mozambique material is unpigmented (Pattern D).

Summary of Geographic Variation. The populations from the eastern and western portions of the range have thus been shown to differ in numerous characteristics (table 9). Eastern (*M. s. sphenorhynchus*) and western (*M. s. mauricei*) can easily be distinguished by the arrangement of the ocular and adjacent head shields and by the number of body annuli.

MONOPELTIS FORM X
(scalper)

Monopeltis Form X (*scalper*) shows considerable variability in head segmentation (Witte,

TABLE 9
Character States for Eastern and Western Races of *Monopeltis sphenorhynchus*

		sphenorhynchus	mauricei
Number		N=130	N=101
Ranges:			
Ventral annuli		228-284	275-316
Lateral annuli		3-6	3-7
Caudal annuli		7-11	8-12
Extra dorsal			
half-annuli		−9 to +3	−7 to +14
Midbody segments			
dorsal		22-37	30-45
ventral		14-26	16-29
Frequencies:			
Laterals	3	18½	1
	4	63	28
	5	17	42
	6	2½	14½
	7	−	½
Caudals	7	1	−
	8	8	7
	9	51	29
	10	38	30
	11	5	14
	12	−	3
Postgenials			
First row	2	128=96%	97=98%
	3	5	1
	4	−	1
Second row	3	12	11
	4	22	15
	5	89	56
	6	7	13
	7	2	−
Upper labials	2	11	−
	3	116	94½
	4	−	1½
Lower labials	2	103	2
	3	24	94
	4	−	1
Head Shield type	1	75	74
	2	9	−
	3	3	21
	4	1	4

1954), pigmentation, and some meristic characters. Laurent (1954, p. 69) suggested that the sample from Kamina represented a distinct race, and that the assemblage was otherwise polytypic;
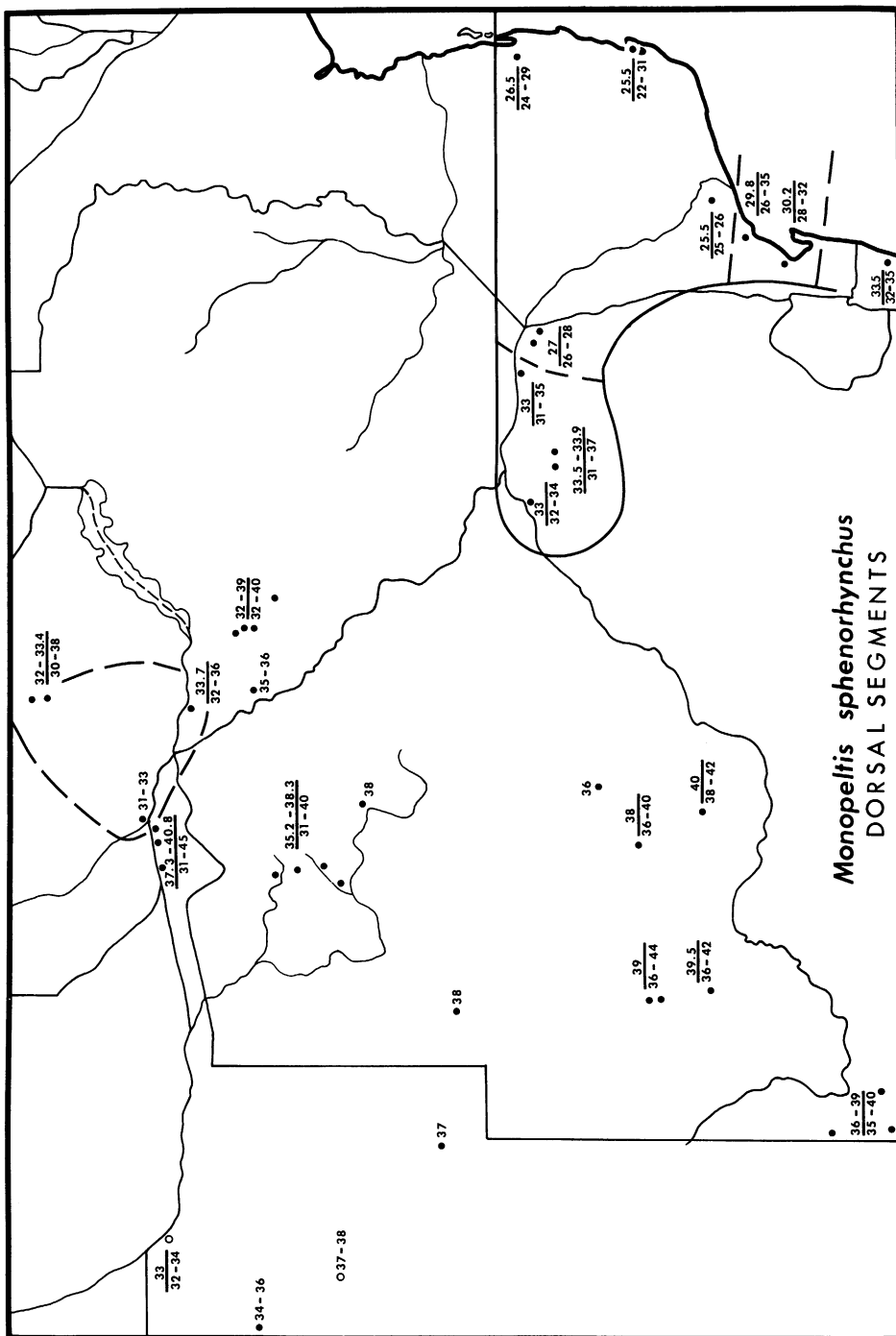
FIG. 31. *Monopeltis sphenorhynchus.* Geographic variation of the number of dorsal segments to a midbody annulus. Conventions as in figure 14.
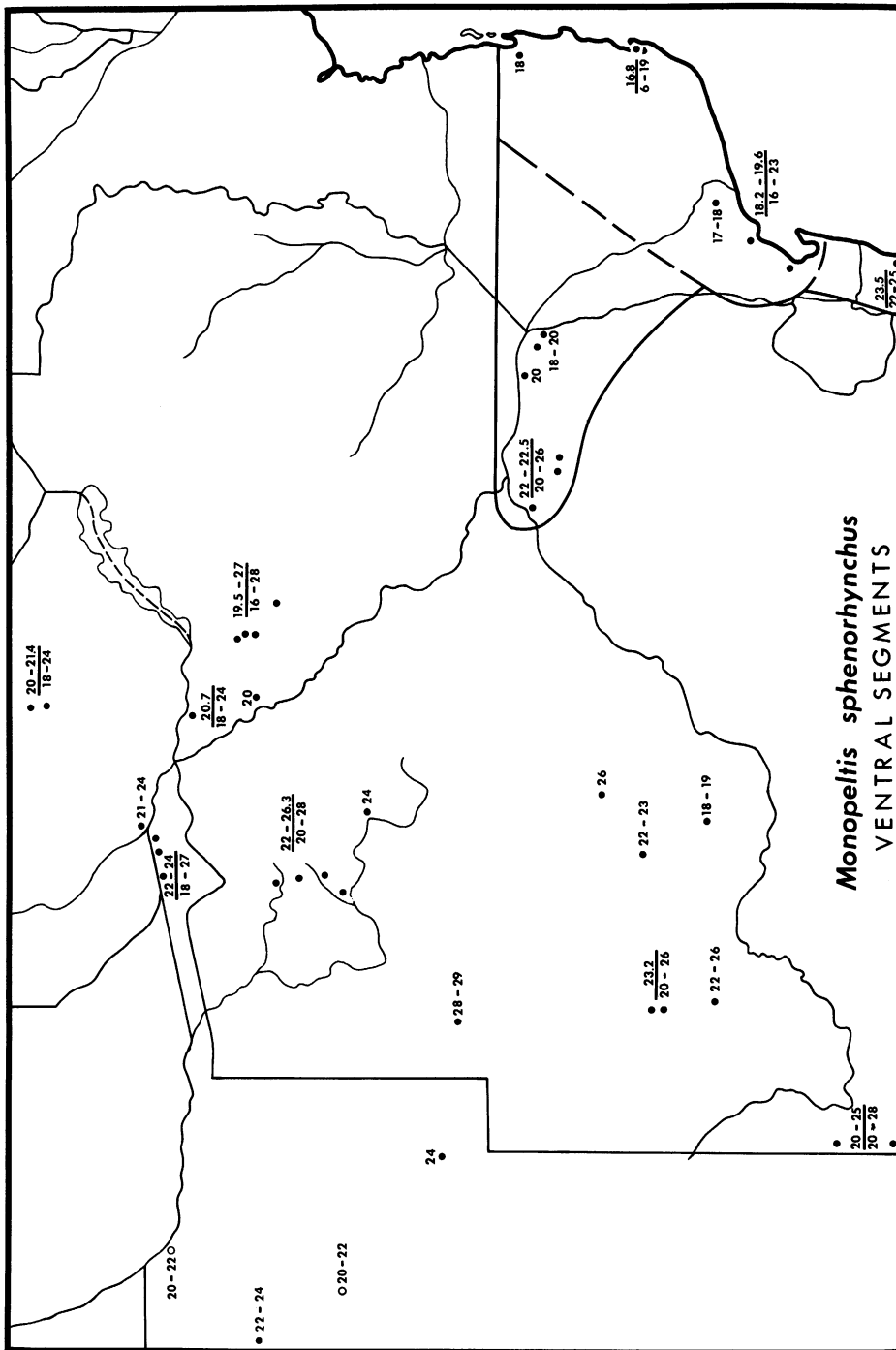
FIG. 32. *Monopeltis sphenorhynchus*. Geographic variation of the number of ventral segments to a midbody annulus. Conventions as in figure 14.

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it might even include more than one species. The sizes of the individual samples are small and the mapping of characteristics does not support his ideas. If geographic variation exists, it is more complex than suggested. One of the distinguishing characters of the Kamina race is the presence of a discrete ocular, but oculars are lacking only in the specimens from Sanga and Bukena, as well as asymmetrically in the individual from Munoi. Specimens from other localities have oculars (and the four aberrant individuals from Kikondja have preoculars as well). The highest count (225) of body annuli is that of the specimen from Manono; the lowest count (191) is that of the specimen from the closest locality (Bukena). Specimens from the three localities to the east of Lac Upemba have the next lowest counts; in one case the individuals represent one end of a sample range that overlaps and almost includes that of most western localities; in the other we are dealing with single individuals. The evidence for polytypy is not convincing.

MONOPELTIS FORMS X, XI, AND XII
(scalper, vanderysti, and luandae)

The literature suggests that Forms X (*M. scalper*) and XI (*M. vanderysti*) are polytypic, but mapping of their character states does not confirm this. Several factors are involved. (1) The body proportions of the several species fall on a simple regression line, which shows little spread considering the age and diversity of the sample. Geographical extremes do not correlate with extreme characteristics. (2) The characterization of body proportions and of pectoral segment proportions by simple ratios masks trends, as ratios will be confused by allometric growth. Body diameter in *M. zambezensis* is 25 at 90 mm., 30 at 140 mm., and 37 at 260 mm. snout-vent length. (3) Cephalic segmentation (post-mentals in continuous or interrupted row, nasal-preocular contact) vary among and within geographical samples of this species. (4) Numbers of body annuli must be counted along the ventral surface and the supernumerary annuli noted separately. Comparisons of counts made along the dorsal and ventral surfaces may lead to confusion.

Only for a single character state does the composite sample show any significant trends that should be noted.

Specimens of Form XI (*M. vanderysti*) from west of the Kwango River—localities Mayombe, Lemfu, Wombali (Zaire), and Sanza Pombo (Angola) have lower counts of body annuli (219-225) than those from farther east; specimens from Banningville, Lac Leopold II, Bokoro, Makaw, Ipamu, Lubue, "Kasai," Leverville, Kahemba (Zaire) and Dundo (Angola) have 226-244. However, two of the most extreme counts are adjacent, 220 at Wombali and 244 at Banningville on the opposite bank of the Kwango.

Although the sample of Form XII (*luandae*) from Luanda also has low body annuli counts, so does Form X (*scalper*) from southeastern Zaire. As none of the other characteristics examined are associated with increase in body annuli, the situation is here noted for the attention of future workers who may have more specimens available.

DALOPHIA FORMS II, III
(pistillum, longicauda)

General. Form II has the widest range in the genus ranging from Angola through Zambia and Rhodesia to Mozambique and south to Botswana, South West Africa, and the northern Cape Province of South Africa. The sympatric (or parapatric) Form III is restricted to a small zone in northwestern Rhodesia, the Caprivi Strip, and Botswana. These species show no apparent variation in anterior lateral annuli, lateral annuli, supernumerary half-annuli, labial segments, and segments to the first postgenial row.

Ventral Body Annuli. Geographical variation of ventral annuli is shown in figure 33. In *D. pistillum* most sample means fall within the range 300-330, but higher counts (M=335-347, R=328-352) are found in southwestern Botswana. The lowest counts are found in eastern Zambia (R=292-307) and Mozambique (R=280-315). *Dalophia longicauda* has higher average counts than parapatric *D. pistillum*, but the longest series from the eastern Caprivi has a wide range of variation (M=324.5, R=307-336). Counts are slightly higher at Victoria Falls (M=336.7, R=336-338), but lower in Wankie National Park (M=321.0, R=318-325).

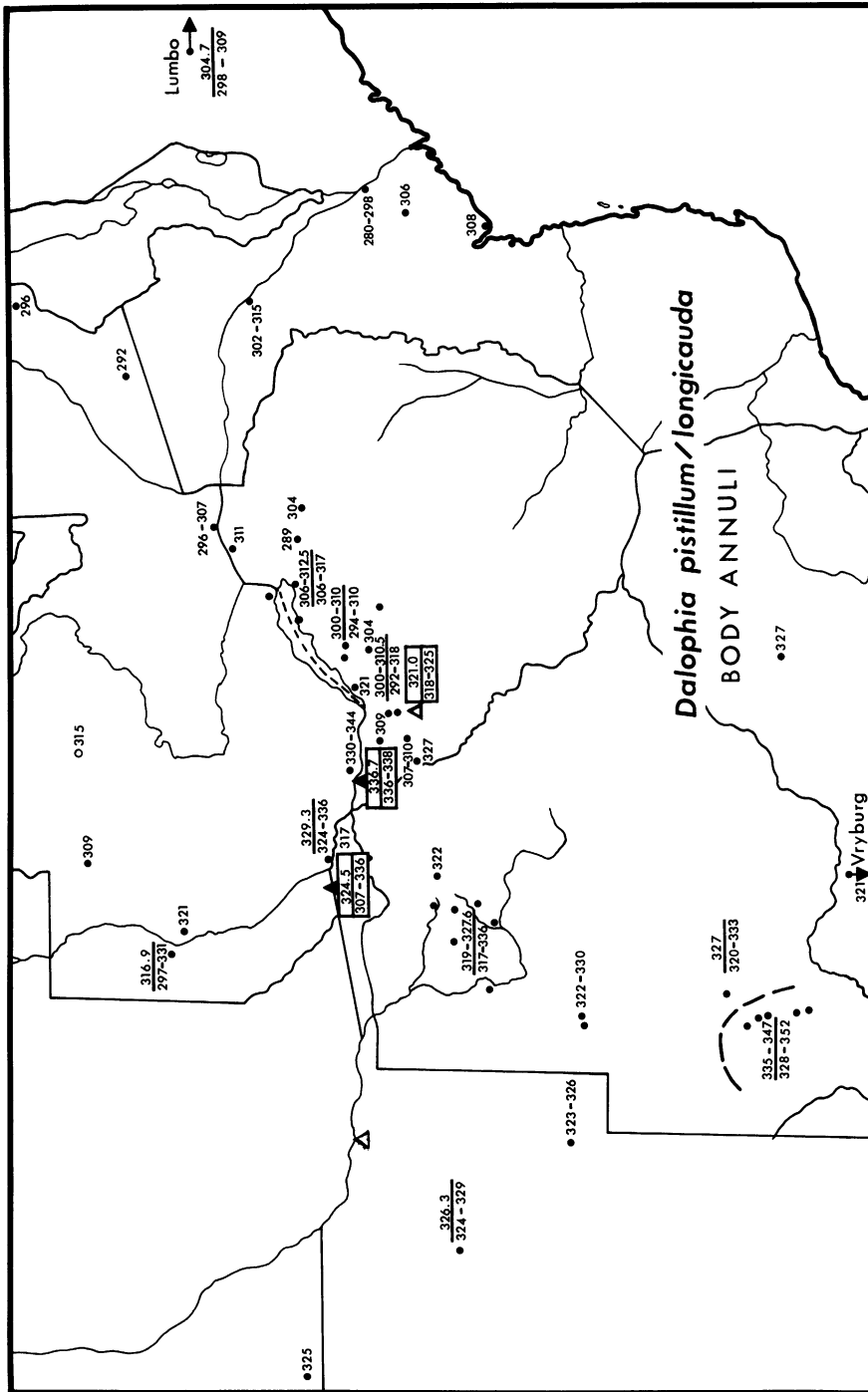FIG. 33. *Dalophia pistillum* and *D. longicauda.* Map showing approximate variation of number of body annuli across the geographic range. Dots stand for records of *D. pistillum*, and triangles for those of *D. longicauda*; solid symbols for specific localities, open ones for general regions. The two arrows point to localities of Lumbo and Vryburg that lie beyond the confines of the map. Other conventions as in figure 14.

Caudal Annuli. Variation of caudal annuli is illustrated in figure 34. The highest counts in *D. pistillum* are found in South West Africa (R=28-31) and northern Botswana (M=28-31.5, R=26-33), dropping slightly to M=26-28, R=26-29 in southwestern Botswana and M=25-25.5, R=23-30 in western Zambia. The lowest counts are in the Wankie District of Rhodesia (M=20.1-21.7, R=19-23), the populations farther east having slightly higher counts within the range 20-25. The counts in *D. longicauda* are highest in the eastern Caprivi (M=39.3, R=36-46), decreasing slightly eastward to the Wankie District of Rhodesia (M=37-39, R=33-44).

Dorsal Segments. In *D. pistillum* counts of dorsal segments to a midbody annulus are usually above 20 in South West Africa, South Africa, and Botswana, declining slightly toward the northeast, with a minimum mean of 17.7 at Lumbo in northern Mozambique. *Dalophia longicauda* also has counts around 20.

Ventral Segments. In most populations of *D.*

pistillum counts of ventral segments fall within the range 14-16, but in western Zambia and the Zambezi Valley counts of 12-14 are usual. In *D. longicauda* counts are usually 12-14.

Second row of Postgenial Scales. No variation occurs in the second row of postgenial scales except for a small high count group of *D. pistillum* (M=10.8-15.5) in western Zambia.

Size and Proportions. The two species have approximately equal snout-vent length (fig. 35), with the modal values greater than those of all but *D. gigantea.*

Figure 36 represents a scatter diagram of the relative tail versus snout-vent length for the several populations in regions where *D. pistillum* and respectively *D. ellenbergeri* and *D. longicauda* are sympatric. Although the range of *D. pistillum* clearly overlaps that of both forms, analysis shows that it is easily discriminated from each of the other two in situations where the forms are sympatric. This again confirms the decision that they behave as good species.

ATTRIBUTION OF NAMES

The oldest name in the assemblage is *Monopeltis capensis* A. Smith (1848). The syntypes (BM 65.5.179:RR1946.8.31.96-RR1946.8.31.97), which were used in the analysis, are in fair condition. The type locality is "24° Lat. S.," but they were allegedly taken on the Limpopo River (Kirby, 1965). It seems more likely that Smith actually obtained them farther south in the northern Cape Province or southwestern Transvaal. Smith was at the alleged type locality in August-September, 1835, at the end of the dry season, which is an unlikely time to collect *Monopeltis.* It seems more likely that the types were, in fact, obtained in May, 1835, somewhere between Kuruman and Zeerust. The specimens agree with material of Form I from this region, whereas the few individuals more recently collected near the putative type locality are pigmented and have four rather than two or three chin shields.

The second name is *Dalophia welwitschii* Gray (1865). The syntypes (BM 64.7.13.34:RR1946.-8.20.89-64.7.13.33:RR1946.8.20.90), which were

used in the analysis, were collected at Pungo Andongo, Angola. These individuals have a caudal autotomy site and the typical truncate tail. The nasals are not in contact nor are there widened segments on the dorsal surface of the tail. The middorsal sulcus is poorly indicated and numerous diagonal folding lines cross the back, whereas some annuli continue across the back to wedge between the opposite set. The generic name *Dalophia* hence pertains to the assemblage with truncate tails, and the name *D. welwitschii* belongs to the western Angolan form.

In 1873 Bocage described *Lepidosternon (Phractogonus) anchietae* from Humbe, which is close to the Cunene River at longitude 15° E (Hill and Carter, 1941). He illustrated the type (Bocage, 1895, pl. 8) and noted that it was a single specimen taken at the same locality as a series of *Monopeltis capensis.* The type, now in the Museu Bocage (MBL T46-525), was reexamined. The name is applied to *Monopeltis* Form II, as the adult holotype has a divided head shield, dark pigmentation, eight parietals,
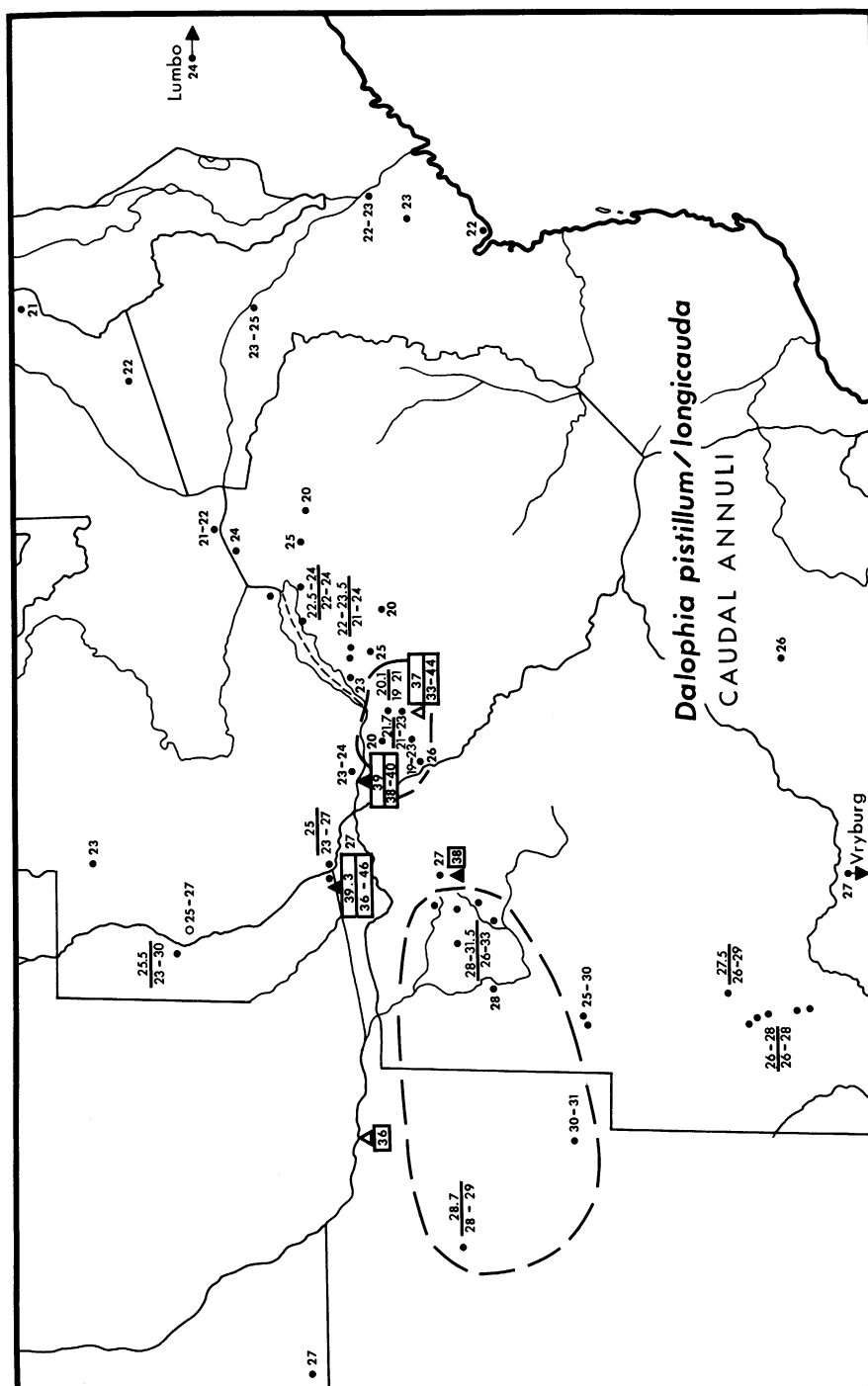
FIG. 34. *Dalophia pistillum* and *D. longicauda*. Geographic variation of the number of caudal annuli. Conventions as in figure 33.
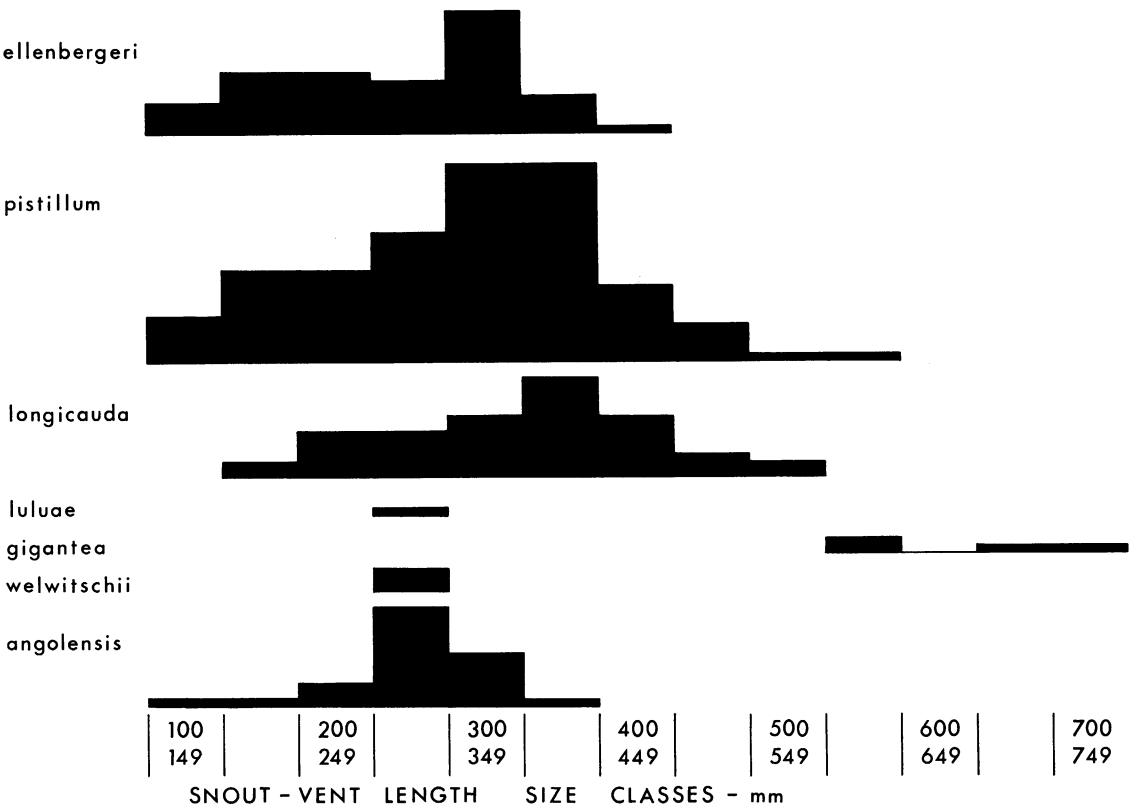
FIG. 35. *Dalophia*. Histogram for snout-vent lengths of the various species of the genus. The vertical bar shown under *D. luluae* represents a single specimen.

four pectorals, and five laterals. It is aberrant in lacking precloacal pores.

In 1876 Günther described *Phractogonus scalper*, noting only that it had been taken by Lieutenant Cameron on his trip across Africa. The type (BM 76.7.1.2:RR1946.8.9.1) is in the British Museum and its data are used in the analysis. Boulenger (1885) ascribed the specimen to Angola, but information in the catalogue of the British Museum is given as "Kilemba in Urua." "Urua" is lacking in the "Republic of the Congo (Leopoldville) Gazetteer" of the U.S. Board on Geographic Names, but the Urua Mts. are shown as a range fringing the northwestern shore of Lake Mweru, Zaire (a site not reached by Cameron), on the insert map to volume 1 of Stanley (1879), whereas Kilemba, a site on Cameron's route, is shown farther to the west, near Kabongo. The closest current entry among

the miscellaneous sites of the same name seems to be Kilembe at latitude 7°40′S, longitude 26°03′E. The name pertains to the smaller species of *Monopeltis* from southeastern Zaire.

In a footnote to a paper on species of *Leposternon* Peters (1879) described *Monopeltis sphenorhynchus* based upon specimens from Mozambique and Angola, characterized by having two rather than three infralabials and two rather than four anterior postgenials, as well as much widened midventral segments and only 20 instead of 32-34 segments to an anterior annulus. Four specimens were listed as having 207, 224, 230, and 252 body annuli as well as two precloacal pores. The description was amplified in 1882 (p. 87). He then referred to body annuli of 225-252 and restricted the type locality to Inhambane. He mentioned that the nasal did not contact the lip, and the presence of irregular

diagonal folding lines across the back. He gave the dimensions of one specimen at 320+17 mm. with a diameter of 7 mm. He caught one specimen during September, 1846, in Inhambane under a piece of wood; later he obtained two others from the same locality, one of which was presented to the Leiden Museum. Peters (1879) on page 13, figures 1-3, illustrated head, pectoral region and tail of two specimens, without indicating their source or museum number. Both specimens show two lower labials. In one specimen the nasal is shown in broad contact with the lip and there are only two upper labials; in the other the nasal barely reaches the lip and is followed by three upper labials.

The name *M. sphenorhynchus* might then be considered to appertain to five specimens, the original and presumably large specimen from Inhambane (ZMU 1400), two additional individuals from Inhambane (ZMU 9423 and RMNH

3564) and two specimens from Angola (ZMU 9000 A and 9000 B). Wermuth (*in litt.*) indicated that ZMU 1400 and 9423 referred to Inhambane whereas ZMU 9000A and 9000B referred to two specimens from Humbe, Angola. (Could these be part of the material referred to by Bocage, 1895, p. 28?)

We have examined all five specimens. The count of body annuli for the Leiden (RMNH 3564) specimen significantly exceeds Peters's range and hence this specimen seems to have been sent off before the typical description was prepared; consequently it does not deserve the status of syntype. However, its characters (used in the analysis) place it with the eastern population of the slender, high annular count *Monopeltis* (Form IV). The two other specimens (ZMU 1400 and 9423) are also Form IV and their data have been used in the analysis. Their numbers of body annuli are lower than those of other Mozambique
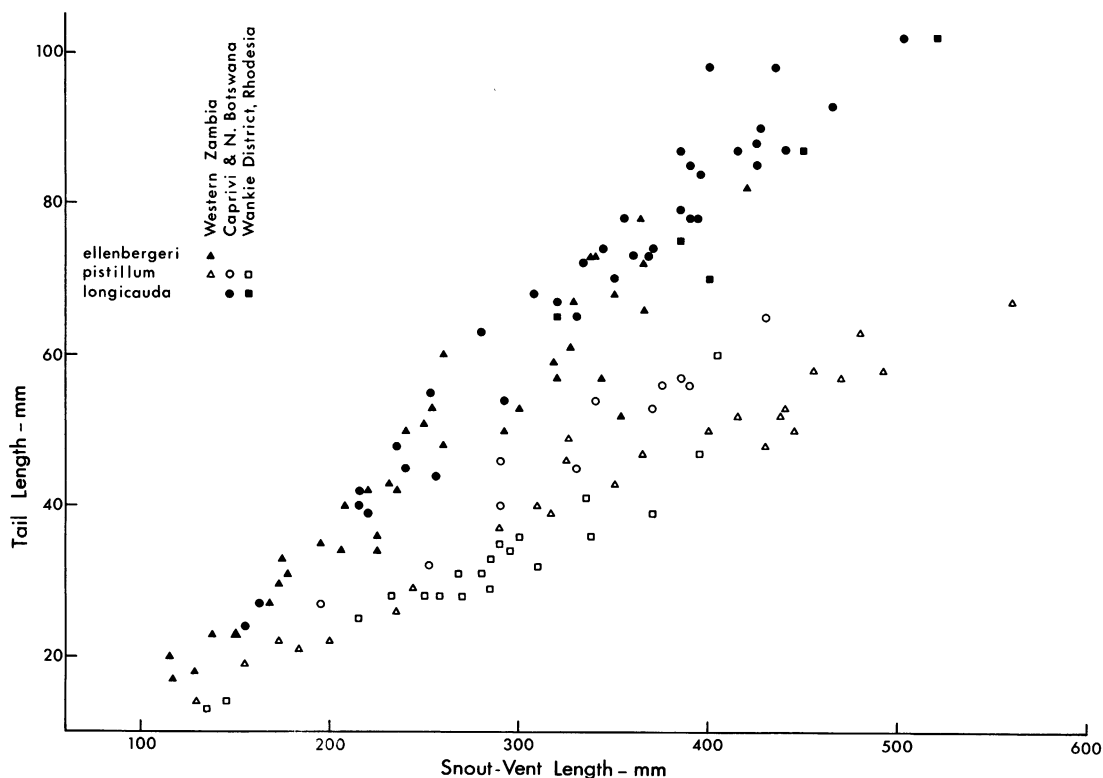

FIG. 36. *Dalophia*. Scatter diagram showing tail length versus snout-vent length for areas where *D. pistillum* is sympatric or parapatric with either *D. ellenbergeri* or *D. longicauda*.

specimens, from which they also differ by lower numbers of segments to a midbody annulus.

ZMU 9000A and ZMU 9000B are clearly *M. capensis*. Their characteristics suggest that they belong to the series from Humbe, Angola, described under that name by Bocage (1892), so that the Lisbon series was apparently split, with two remaining there, two going to Berlin, and a fifth to Frankfurt. As RMNH 3564 cannot be considered part of the type series and ZMU 9000A and 9000B are *M. capensis*, we here designate ZMU 1400 as lectotype and ZMU 9423 as lectoparatype. The name *M. sphenorhynchus* then pertains to the southeastern population of *Monopeltis* Form IV.

Monopeltis pistillum was described by Boettger in 1895, based on three specimens (SMF 5455 2a), one of which is recatalogued as SMF 11833, another is apparently in Vienna (NMW 12354:1). As this is labeled Boroma (a mission station some 20 km. upstream from Tete), a locality ascribed by Mertens (1967, p. 100) to the type of *Elapsoidea boulengeri*, which Boettger described in the same paper, it is probable that all three syntypes came from there. Boettger mainly emphasized differences from *Monopeltis welwitschii*, and the dimensions given in his description are those of the Senckenberg specimen. Hence it is chosen as lectotype and the type locality restricted to Boroma, Mozambique. The name clearly pertains to Form II of *Dalophia*.

Monopeltis giganteus was described by Peracca in 1903, based upon two specimens from the "Congo" (Zaire). One is still in Turin (IMZUT 2844) and the other, included in the analysis, is MSNG CE 36071. These very large specimens have a divided head shield, incompletely separated preoculars, and a low number of caudal annuli, but otherwise do not differ significantly from *D. pistillum*. The appropriate name pertains to the giant northwestern species of Form IV of *Dalophia*.

In 1907 *Monopeltis granti* was described by Boulenger, based on a single specimen (BM 1907.4.20.33:RR1947.8.31.98) from Beira, Mozambique. Boulenger only mentioned comparison of the type with *D. welwitschii*. The type was used in the analysis and the name seems to belong in the synonymy of *D. pistillum*. The posterior dorsal surface and the tail of this speci-

men is now pale brown. In life the pigmentation probably resembled that of a freshly collected individual from Inhamitanga which has the posterior dorsum and tail dark gray. The slender, pointed head of the type has misled subsequent authors; autually this is a juvenile and similar allometric changes in head shape seem to be the rule in amphisbaenian species. Beira is at present the most southerly record of *D. pistillum* in the east.

In an appendix to a list of South African reptiles and amphibians, Boulenger (1910, p. 495) named two new forms. The first of these is *Monopeltis decosteri*, based upon a single specimen from Delagoa Bay (=Lourenço Marques), Mozambique. The type is SAM 650. The illustration of the head shields by FitzSimons (1937b, 1943) is inaccurate; in particular there are only four parietals, not six as illustrated. The type is soft and appears to be badly bleached. The species was placed close to *M. capensis* and was apparently erected mainly because of the presence of two rather than three pairs of pectoral plates and 34 rather than 40-50 segments in a midbody annulus. As both of these characteristics seem to occur irregularly in various parts of the range, the name is a synonym of *M. capensis*, but is available should an east coast race be recognized.

The second form is *Monopeltis colobura*, based on three specimens taken by the Reverend L. Jalla at Sesheke, Barotseland (Zambia). One of these is now in the British Museum (BM 1910.6.18.11:RR1946.8.8.96) and two remain in the South African Museum (SAM 4661 and 4663). The data for these specimens are included in the analysis and the name belongs in the synonymy of *D. pistillum*.

Also in 1910, Peracca described *Monopeltis jallae*, based upon another collection received from the Reverend Luigi Jalla, but ascribed only to the upper Zambezi (Barotseland). Peracca had earlier (1896) reported on a collection of Jalla's from south of the Zambezi. Only one of the two types (MSNG CE 37466) was used in this analysis and it shows that Loveridge (1941, p. 434) was correct in his suspicion that the number of body annuli, which Perraca gave as 223, was an error. The tail lacks an autotomy annulus and the name hence belongs in the synonymy of *D. pistillum*.

In 1910 Werner erected the name *Monopeltis*

leonhardi, based on a specimen from the Kalahari between Kgogong and Kang, Botswana. The holotype is in the Zoological Museum of Berlin (ZMU 23201).[1] Since Werner (1910a) apparently had only a single specimen (no. 1089, Schultze Collection) Barbour and Loveridge (1929) were wrong in assuming that MCZ 21030 from Gobabis, South West Africa, has typical status. The type has a divided head shield, dark pigmentation, six parietals, six pectorals, three laterals and lacks precloacal pores so that the name is available for *Monopeltis* Form III.

In a footnote to the same paper, Werner (1910a) also named *M. quadriscutata* based on two specimens (Gans, 1967) from German South West Africa. The syntypes were destroyed during World War II, but the description (Werner, 1910b) mentioned four pectoral shields, which confirms that the name probably belongs in the synonymy of *M. anchietae*.

In 1913 Boulenger described *Monopeltis gerardi* from Kikondja, Katanga (Zaire), based on a single small specimen (RGMC 1201); which has been reexamined; we also saw two presumptive topotypes (NMW 12352a, 12352b) sent by Gerrard, the collector, in the same year. The holotype is a juvenile specimen of the *M. scalper* group; its pores are none too obvious. Boulenger only compared his specimen with *Dalophia gigantea* and did not mention *M. scalper*, presumably believing that the latter occurred only in coastal Angola. The type localities of the two forms are actually quite close and the name *M. gerardi* is hence a strict synonym, although the high counts of dorsal segments and the presence of a discrete preocular suggest that it may pertain to the specimens from the same locality here marked *incertae sedis* under *M. scalper*.

In 1915 Werner described *Monopeltis* ? *colobura* (*longicauda*, new species) from a single damaged specimen from "Okawango," South West Africa (between 19° and 21°30′E longitude). The type (HM 4275) survived World War II, despite an earlier statement to the contrary (Gans, 1967, p. 88), and its data have been included in the analysis. The name is clearly assignable to the long-tailed Form III of *Dalophia*

and it is a pleasure to assign the appropriate name *D. longicauda* to that species.

In 1920 Angel described *Monopeltis ellenbergeri* from Lealui District, upper Zambezi (Zambia), based on three specimens (MHNP 20-78, 20-79, and 20-80); the data have been included in the analysis. The types agree completely with Form I of *Dalophia* and the name *D. ellenbergeri* is hence available for this.

In 1922 Witte described three new species from the Congo Belge (Zaire). The first was *Monopeltis vanderysti* based upon individuals from four localities. The lectotype (Gans, 1967, p. 86) is RGMC 1872 from Wombali (dist. Lac Leopold II) and the lectoparatypes are RGMC 897 from Lac Leopold II, RGMC 92 from Kasai, and RGMC 2309 from Leverville (Kwango). Witte considered this form distinct by the combination of two large head shields, two unkeratinized preoculars and absence of femoral pores. The name hence belongs to *Monopeltis* Form XI from eastern Zaire.

The second species he described in 1922 was *Monopeltis lujae* based on an individual (RGMC 505) from Lubue, Kwango District. This form was considered distinct from *M. vanderysti* because of its single large head shield, three instead of four upper labials and some annular segments fused ventrally, occasionally to the loss of a midventral raphe. The type was examined. As all these characteristics reflect individual and ontogenetic variations, this name is a synonym of *M. vanderysti*, but remains available should subspecific recognition be given to the eastern specimens with high counts of body annuli.

Finally Witte (1922) described *Monopeltis truncata* based upon a very large specimen (of *Dalophia*) from Kwango District (RGMC 32), which he compared mainly with *M. colobura* and from which it was stated to differ by the presence of a preocular, greater number of ventral segments to an annulus, and the occurrence of straight rather than angled sutures between the caudal annuli. The holotype (which was examined) does have narrow medial fusion of the two enlarged head shields and lacks a caudal autotomy annulus. The preoculars are well defined. The name pertains to the giant *Dalophia* from Zaire and hence belongs in the synonymy of *D. gigantea*.

In 1931 Monard described *Monopeltis okavan-*

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[1] Not in the Hamburg Museum as erroneously stated in Gans (1967) nor in the Vienna Museum as suspected by FitzSimons (1943).

gensis from Vila da Ponte and Caquindo (=Kakindo), Angola (on the Cubango River); the syntypes are LCFM (two unnumbered) from Caquindo and Vila da Ponte and NMB 13331 from Caquindo. All these specimens were included in the analysis and the name appears to be a strict synonym of typical *M. anchietae* of which these are the most northerly records. It is interesting that they agree with the type of *M. anchietae* from Humbe, Angola, in lacking the precloacal pores otherwise typical of this form.

In 1932 FitzSimons described *Monopeltis vernayi* from Gomodimo Pan, central Kalahari (Botswana). The holotype is TM 14468. A second specimen from Kuke Pan (FMNH 17268) was not mentioned until his 1935 paper and therefore FMNH 17268 cannot be considered a paratype. The data for both specimens were used in the analysis. The holotype matches Form III of *Monopeltis* and the name is hence a synonym of *Monopeltis leonhardi*. The second (nontypical) specimen falls into Form I (*M. capensis*) and is a juvenile with type 3 head shield pattern.

In 1933 FitzSimons described *Monopeltis granti transvaalensis* from "Hope" farm, between Nylstroom and Vaalwater, Waterberg District, northern Transvaal, based upon a holotype (TM 14354) and a paratype (TM 14353). The types were included in the analysis and the name is a synonym of *D. pistillum*.

In 1933 Witte described *Monopeltis remaclei* from Lukulu near Kiambi, Zaire, based on a single specimen (RGMC 8692), characterized versus all other forms by the high number of body annuli and lack of precloacal pores. The type was included in the analysis and the name pertains to Form VIII, the large stout *Monopeltis* from southeastern Zaire.

In 1934 Cott described *Monopeltis mossambica* from two specimens (Holotype, BM 1933.7.1.2:RR46.8.31.99; paratype, BM 1933.7.1.86) collected at Caia, on the Zambezi in Mozambique. The specimens are included in the present analysis and the name is a synonym of *D. pistillum*.

In 1935 Parker described *Monopeltis mauricei* from "Monjalatsela" near Ghanzi, Botswana. The single, very juvenile specimen is BM 1933.9.9.14:RR1946.8.2.37. The data, which were used in the analysis, indicate that the speci-

men pertains to the western subgroup of *Monopeltis* group IV and this should be referred to as *Monopeltis sphenorhynchus mauricei*.

In 1937b FitzSimons described *Monopeltis habenichti* from Lourenço Marques, based on four specimens, the holotype (TM 3400), two paratypes (TM 3401-3402) and a "topotype" (TM 3323). He compared it with *M. capensis* and *decosteri*. The specimens were included in the analysis and the name pertains to the eastern group of *M. sphenorhynchus*.

In 1937b FitzSimons also described *Monopeltis capensis gazei* from the confluence of the Magalakwin and Limpopo rivers, Zoutpansberg District, northern Transvaal. The holotype, TM 13342, and paratype, TM 3477 (Nwanedzi River, northern Transvaal), were used in the analysis and are typical specimens of low annulus count *M. s. sphenorhynchus* of which this name is a synonym.

In 1937 Monard described *Monopeltis devisi* from Mupa, southern Angola, based on a single unnumbered specimen (LCFM), the data for which have been included in the analysis. These confirm that this name is a strict synonym of *M. anchietae*.

In 1937 Monard described *Monopeltis granti kuanyamarum* on the basis of one specimen from Mupanda, southern Angola (LCFM unnumbered). The data are included in the analysis and indicate that this specimen, which lacks caudal autotomy and has a truncated tail tip, as well as a herringbone pattern of caudal segments, belongs in the synonymy of *D. pistillum*.

In 1941 FitzSimons described *Monopeltis ocularis* from a single adult specimen from Swart Modder, Rietfontein, Gordonia District, northern Cape Province. The type (unnumbered) is in the McGregor Museum, Kimberley. The author compared this form with the types of *M. habenichti*, distinguishing it on the basis of the much elongated ocular, a single pair of occipitals, nasal not bordering lip, small mental, more numerous body annuli, and more segments to a midbody annulus. The specimen clearly belongs to the western assemblage of the slender, high annulus group of *Monopeltis* and the name belongs in the synonymy of *Monopeltis sphenorhynchus mauricei*.

In 1942 Witte and Laurent described *Mono-*

peltis luluae from Sandoa, Haut Lomami (Zaire), based on a single specimen (RGMC 10848) and it was examined for this study. The holotype is in pieces, very soft and poorly preserved. The unique individual of *Dalophia* Form IV resembles *D. pistillum* as it lacks caudal autotomy and agrees with more southern populations of that species. However, it differs in its low number of caudal annuli, fewer dorsals to a midbody annulus, absence of fusion or herringbone pattern of the supracaudal segments, and narrow caudal cap. The nasals have only point contact and a slender postnasal contacts the ocular. The species is here retained until more material becomes available.

In 1942 Witte and Laurent also described *Monopeltis kabindae* from Kabinda, "Katanga" (=Kasai), based upon a juvenile specimen of 186 mm. snout-vent length (RGMC 6773). No other specimen has been discovered. The presence of a single azygous head shield in a juvenile specimen makes it unlikely that we are dealing with an aberrant specimen of *M. scalper*, *M. vanderysti* or the *M. guentheri-schoutedeni* group. The tail may be autotomized and healed, but the pectoral arrangement is uniquely regular. There is suspicion that we may be dealing with an extreme northern sample of *M. capensis*, but this species is replaced by *M. sphenorhynchus* and *Dalophia* in the geographical hiatus. The name is hence retained.

In 1953 Witte described *Monopeltis adercae* from Bukena near Mulongo (617 m.), Haut Lomami, Katanga, Zaire (IRScNB 2067). The holotype was included in the analysis. The name is retained for *Dalophia* Form IX, the large species from eastern Zaire.

In 1954 Laurent erected three new forms based upon small collections from Angola and the Congo. *Monopeltis vanderysti vilhenai* based on a holotype (MD 5040) and three paratypes (MD 5183, 5233, 5242) from Dundo, Angola, diagnosed on the basis of various proportional differences, the dense bluish pigmentation of the large holotype, and slightly more numerous body annuli. The holotype is now RGMC 17503, and MD 5233 is now RGMC 17504. The description contains various errors (the count of the holotype is too high by seven, and the tail lengths of two "paratypes" are given as 58 and 48 mm.

which is twice as long as in the specimens). The pigmentation of the holotype seems to represent an artifact or abnormality, as the melanophores seem to have disintegrated and the pigment has diffused even across segmental borders. The pigmentation of the paratype does not differ from that of the other specimens assigned to *M. vanderysti*. As the diagnostic characters do not differentiate these specimens the name remains a synonym of *M. vanderysti*.

In the same paper Laurent erected two new names for subspecies based on material from Zaire. The first was *Monopeltis vanderysti closei* based on the holotype (RGMC 14702, not 14502 as listed in the description) from Kahemba, Kwango (Zaire) and a paratype (RGMC 11953) from the same locality. The diagnosis is based on a rather trivial character and the name is a synonym.

The second was *Monopeltis scalper bulsi* based on material from Kamina, Haut Lomami (Zaire). The holotype (RGMC 16179), and paratypes (RGMC 15917, 16015, 16016, 16178) were used in the analysis. The diagnosis is based upon incomplete separation between the cephalic shields, absence of a preocular, slight proportional differences in tail length and other details. All of these appear in other specimens (including the holotype of *D. scalper*) as well and the name is a synonym of *M. scalper*, even though Laurent in 1956 suggested that it might be a distinct species. He may have been misled as he compared his sample with a series from Kikondja (now in the Dundo Museum and unavailable to us). If a separation becomes necessary, the name *gerardi* Boulenger has priority.

Monopeltis zambezensis (Gans and Broadley, 1974), *M. perplexus* (Gans, 1976), and *M. luandae* (Gans, 1976), as well as *Dalophia angolensis* Gans, 1976) are names for species discovered during the present analysis. Their types were of course available for analysis.

In 1947 Laurent attempted a reclassification of African amphisbaenians, in which he established the generic name *Tomuropeltis* (type species *M. giganteus*) for all but one of the species that Loveridge (1941) had earlier placed into Gray's genus *Dalophia*. He agreed with Loveridge's earlier decision to separate those

species with a truncated tail but argued that the inclusion of *Dalophia welwitschii* (Gray, 1865) was inappropriate as (1) this species did not "really" (*precisement*) have a truncated tail, (2) the absence of precloacal pores sometimes occurred in *Monopeltis*, *sensu strictu*, and (3) the species *welwitschii* did not have contact between the nasals. Unfortunately he did not personally reexamine the types or he would have found that *D. welwitschii* does have a truncated tail. Furthermore, the nasals may not contact each other in individuals of some other species of *Dalophia* as well. None of the other meristic char-

acteristics used by Laurent to separate the genera still holds. It is clear that *Dalophia welwitschii* is the species of the *Dalophia* group closest to *Monopeltis* and one might regret that a structurally intermediate form becomes the type species. Nevertheless we see little merit in breaking the sequence between *D. welwitschii* and *D. luluae*, rather than between one of the long-tailed *Monopeltis* and *D. welwitschii*. We consequently retain the name *Dalophia* Gray (1865) for the assemblage with truncate tails, in the expectation that the assignment of all the species in this order will be the subject of a separate report.

DESCRIPTIVE ACCOUNTS

GENUS *MONOPELTIS* A. SMITH

Monopeltis A. Smith, 1848 (1834-1849), pl. 67. Type species: *Monopeltis capensis*, by monotypy.
Monaspis A. Smith, 1848 (1834-1849), p. 67. Alternate name for *Monopeltis*, used in plate captions only.
Phractogonus Hallowell, 1852, p. 62. Type species: *Phractogonus galeatus*, by monotypy.
Monotrophis Gray, 1865, p. 454. Type species: *Monotrophis capensis* A. Smith. *Lapsus*, hence not available (Stoll and others, 1961, art. 33b).

Diagnosis (Modified after Vanzolini, 1951). Face strongly flattened dorsoventrally. Nasal bones of skull separated medially by premaxilla but contributing to the anterior edge of the shield. Lower jaw with two postarticular processes. Prearticular not fused to articular-surangular. Dentition 1-5 (premaxilla), 3-4 (maxilla), and 6-7 (dentary). Integument of head formed into one or two azygous cephalic shields that are almost always extensively keratinized. Nasal shields separated by the rostral. Pectoral region always modified, generally covered by very much enlarged, smooth, and thickened shields. Precloacal pores present or not. Caudal tip rounded; autotomy may occur.

KEY TO THE SPECIES OF THE GENUS *MONOPELTIS*

1. Precloacal pores 0-4 3
   Precloacal pores 5-13 2
2. Body annuli 241-263; caudal annuli 22-26; precloacal pores 5-9; snout-vent length 109-356 mm. . . . . *M. guentheri*
   Body annuli 273-289; caudal annuli 25-29; precloacal pores 9-13; snout-vent length 140-660 mm. . . . . *M. schoutedeni*
3. Caudal annuli fewer than 25 4
   Caudal annuli 49-61 . . . . *M. adercae*
4. Pectoral segments more or less longitudinally parallel 5
   Pectoral segments form a posteriorly directed chevron pattern. . . . . *M. jugularis*
5. Caudal annuli 4-12. 11
   Caudal annuli 13-24. 6
6. A midbody annulus with 9-12 dorsal and 7-10 ventral segments; range Gabon . . . .
   . . . . *M. galeata*
   A midbody annulus with 12 or more dorsal and 11 or more ventral segments; range Zaire southward 7
7. Body annuli 191-244; caudal annuli 13-18; supernumerary dorsal half-annuli usually present 9
   Body annuli 251-285; caudal annuli 20-24, supernumerary dorsal half-annuli few or absent 8
8. Two discrete azygous head shields; autotomy absent; a midbody annulus with 21-34 dorsal and 16-19 ventral segments; snout-vent length 350-580 mm. . . . .
   . . . . *M. remaclei*
   Azygous head shields fused; autotomy site at fifth to seventh caudal annulus; a midbody annulus with 12-17 dorsal and 14-16 ventral segments; maximum snout-vent length 300 mm. . . . . . *M. perplexus*
9. A midbody annulus has 29-33 dorsal seg-

ments . . . . *M. luandae*
A midbody annulus has 13-23 dorsal seg-
ments 10
10. A small preocular present or absent; a mid-
body annulus with 13-19 dorsal segments;
a pair of precloacal pores present . . . . . .
. . . . *M. scalper*
Two large preoculars; a midbody annulus
with 18-23 dorsal segments; no pre-
cloacal pores. . . . . *M. vanderysti*
11. Body annuli less than 222; supernumerary
dorsal half-annuli usually present . . . 12
Body annuli more than 222; supernumerary
dorsal half-annuli few or absent 15
12. Two discrete azygous head shields; dorsal
pigmentation uniform from nuchal re-
gion to tail tip and extending ventral to
the lateral sulci 13
Azygous head shields usually fused in adults;
dorsal pigmentation (if present) patchy
and not extending below the lateral
sulci 14
13. First transverse of parietals usually 8-13;
pectorals usually 4; laterals usually 5-7;
usually 2 precloacal pores; ocular usually
separated from second supralabial. . . . . .
. . . . *M. anchietae*
First transverse row of parietals usually 4-7;
pectorals usually 6; laterals usually 3, 4;
no precloacal pores; ocular usually in
contact with second supralabial . . . .
. . . . *M. leonhardi*
14. Supernumerary dorsal half-annuli usually 13
or more; total segments in a midbody
annulus usually more than 40; ocular
moderate, in contact with second supra-
labial; tail usually not more heavily
pigmented than body . . . .
. . . . *M. capensis capensis*
Supernumerary dorsal half-annuli usually 12
or fewer; total segments in a midbody
annulus usually fewer than 40; ocular
very small or absent, not in contact with
second supralabial; tail usually more
heavily pigmented than body . . . .
. *M. capensis rhodesianus*, new subspecies
15. A midbody annulus with 22-45 dorsal and
16-29 ventral segments. 16
A midbody annulus with 18-20 dorsal and
13-16 ventral segments. 17
16. Ocular separated from the nasal by second
supralabial; oculars small and separated
from the medial pair of parietals by
lateral parietals; body annuli 228-284 . . .
. . . *M. sphenorhynchus sphenorhynchus*
Ocular usually in contact with the nasal or

postnasal; oculars elongate and usually
in contact with the medial pair of pari-
etals; body annuli 275-316 . . . .
. . . . *M. sphenorhynchus mauricei*
17. Body annuli 226-263; a pair of precloacal
pores present . . . . *M. zambezensis*
Body annuli 223; no precloacal pores . . . . .
. . . . *M. kabindae*

Monopeltis anchietae Bocage
Figures 10, 20, 23-29, 37-40

Lepidosternon (Phractogonus) anchietae Bocage,
1873b, p. 247. *Terra typica*: "Humbe, dans
l'intérieur de Mossamedes, pres des Bords de
la rivière Cunene," Angola. Holotype: MB
T46.525.
Monopeltis quadriscutata Werner 1910a, p. 328.
Terra typica: "Deutsch-Südwestafrika." Syn-
types: Formerly in the Zoologisches Museum,
Hamburg; destroyed.
Monopeltis okavangensis Monard, 1931, p. 95.
Terra typica: "Vila da Ponte et de Caquindo,"
Angola. Syntypes: LCFM (unnumbered);
NMB 13331 (Caquindo); LCFM (unnum-
bered) (Vila da Ponte).
Monopeltis devisi Monard, 1937, p. 69. *Terra
typica*: "Mupa," Angola. Holotype: LCFM
(unnumbered).

Diagnosis. A medium-sized (200 to 345 mm.
snout-vent length in adults) robust species of
Monopeltis with the dorsal surface heavily pig-
mented from nape to tail tip and this coloration
extending below the lateral sulcus. The species
has 170 to 198 body, five to seven (rarely four)
lateral and five to nine caudal annuli (up to the
bluntly rounded tip), 18 to 19 dorsal plus 11 to
27 ventral segments to a midbody annulus, and
two to five (usually four) first and five to 11
second postgenial segments. The azygous head
shields are paired, the ocular being wedged
between them. There are no preoculars. The
nasals are short and do not contact the oculars,
the lip or each other. There are six to 13 (usually
eight or 10) parietal shields. The pectoral zone is
rectangular and the sutures between the four
(very rarely six) shields are parallel. They corre-
spond to four or five dorsal body annuli. The
ventral segments of the prepectoral annulus are
slightly enlarged, but not involved in the pectoral
shields. The lateral sulci are clearly expressed,
but neither dorsal nor ventral sulci are obvious.
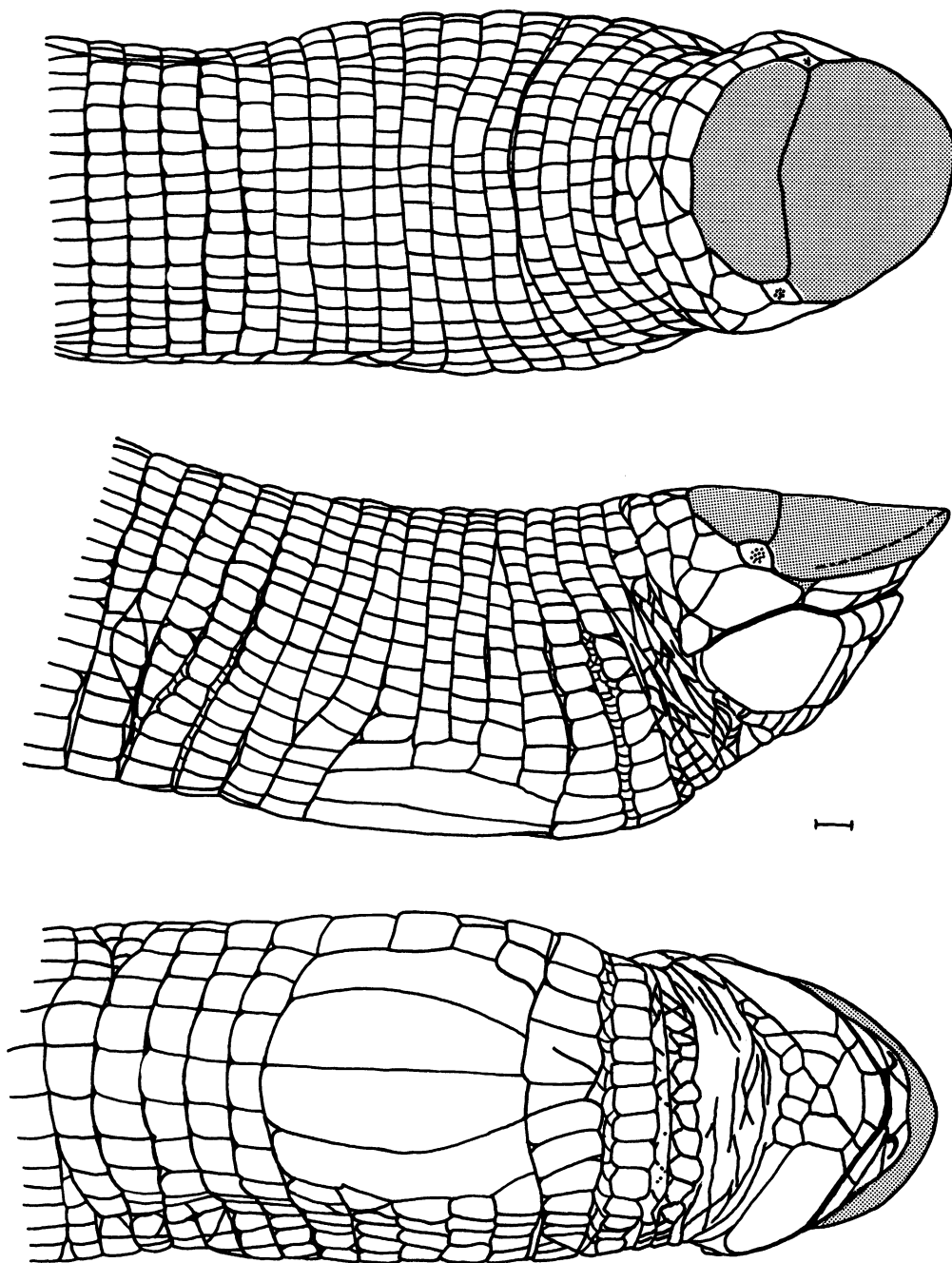Diagonal folding lines occur. There are six to 28

FIG. 37. *Monopeltis anchietae.* Pattern of head scalation. Dorsal, lateral, ventral views of head and pectoral region of SAM "B," no data. The line equals 1 mm. to scale.

supernumerary dorsal half-annuli, most of these corresponding to the first 50 body annuli. The

dorsal interannular sutures cross the body at right angles to its long axis. Usually two pre-

cloacal pores lie on small segments lateral to the precloacal shields. No autotomy occurs.

Description. This is a medium-sized species of *Monopeltis* with the available specimens ranging from 90 to 345 mm. snout-vent length (fig. 20). The dorsal surface from nuchal region to tail tip is heavily pigmented reddish brown; the pigmentation usually extends for four or five segments
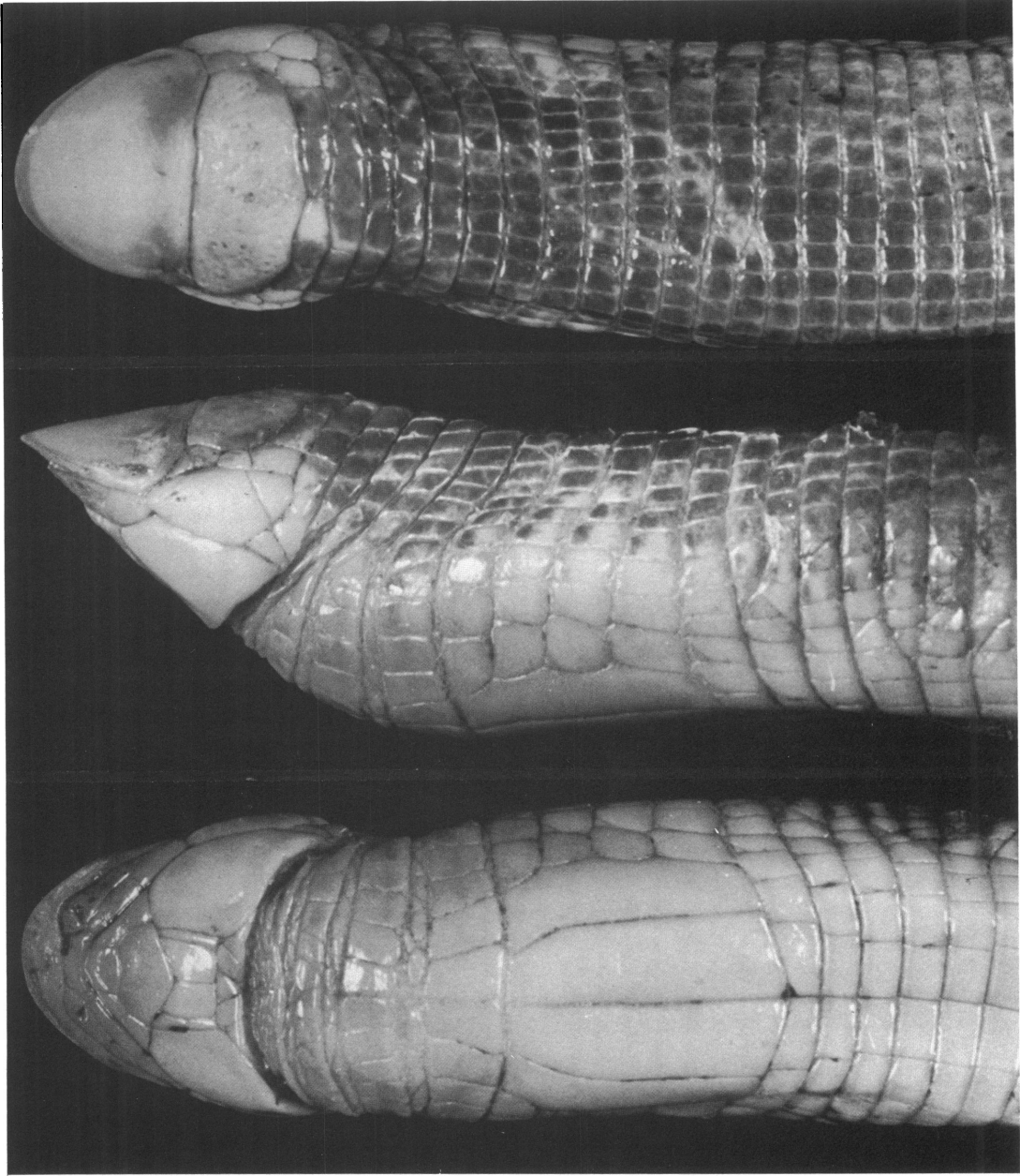
FIG. 38. *Monopeltis anchietae.* Dorsal, lateral, and ventral views of head of and pectoral zone of UM 23010 from 15 km. WSW of Katima Mulilo, Caprivi Strip, South West Africa.
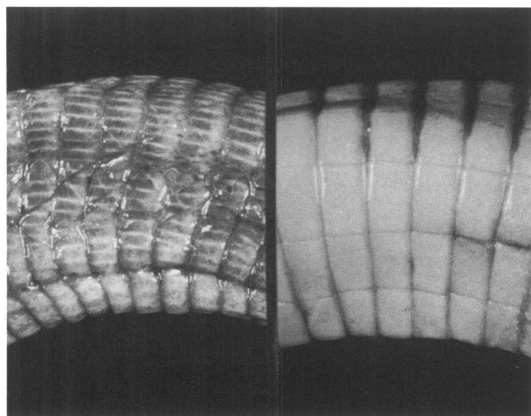
FIG. 39. *Monopeltis anchietae.* Left, dorsal view, and right, ventral view at midbody showing segment arrangement and pigmentation of UM 23010 from 15 km. WSW of Katima Mulilo, Caprivi Strip, South West Africa.

ventral to the lateral sulci and even farther along the interannular sutures. There are usually extensive areas of pigmentation on the large azygous head shields, but the midventral surface is unpigmented, except sometimes for the midventral segments on the tail. The areas of darkest pigmentation are the nuchal region and the dorsal surface of the tail.

The dorsal surface of the head is divided into two azygous shields. The dorsal region of the anterior head shield is concave and that of the posterior shield is convex.

The eye is usually visible as a dark spot beneath the quadrangular ocular, which is well separated from the second supralabial and is usually bordered posteriorly by a small postocular. A series of six to 13 (usually eight or 10) parietal shields links the third supralabials and separates the posterior head shield from the first body annulus.

The nostrils are crescent-shaped and inserted into relatively short nasal scales, which are well separated from the oculars, the lip and each other. There are three supralabials, the third by far the largest.

The lower jaw is covered by a somewhat squarish mental, the first, second, and enormous third infralabials, and the enlarged heart-shaped postmental (genial). Posterior to the postmental are two pairs of first postgenials, the medial and

widest pair in long contact behind the postmental, the elongate lateral pair in contact with the second infralabials. Immediately caudad to the first row of postgenials is a second row of five to 11 much smaller postgenial segments, the larger medial ones bordering the first postgenials, the tiny lateral ones bordering the third infralabials posteriorly.

The modified pectoral region extends to the seventh to eleventh dorsal annulus; there are usually four subrectangular pectorals, the median pair usually slightly narrowed anteriorly, corresponding to four or five dorsal half-annuli. The midventral segments of the prepectoral annulus are slightly enlarged, but are not involved with the pectoral shields.

There are 170 to 198 body annuli from the posterior edge of the third infralabial up to, but not including, the precloacal shields. There are six to 28 supernumerary dorsal half-annuli, most of these corresponding to the first 50 body annuli, although there is usually one extra half-annulus in the precloacal region. A midbody annulus has 18 to 29 dorsal plus 11 to 27 ventral segments. The middorsal segments are approximately two to three times as long as wide and the midventral segments one and a-half to two times as wide as long. The number of dorsal segments is consistently greater than the number of ventral segments for any given specimen. There are generally five to seven (rarely four) lateral annuli, the first two in contact with the pair of enlarged precloacal shields. The segments of the first lateral annulus that border the precloacals bear a precloacal pore (rarely absent).
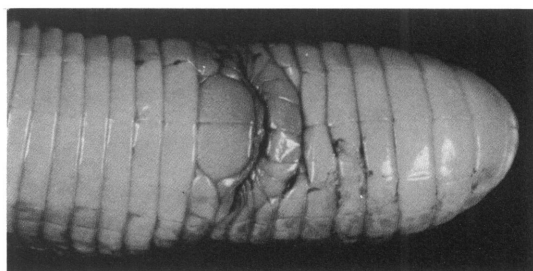
The short tail is smoothly rounded and

FIG. 40. *Monopeltis anchietae.* Ventral view of cloaca and tail of UM 23010 from 15 km. WSW of Katima Mulilo, Caprivi Strip, South West Africa.

appears horizontally oval in cross section. There are five to nine caudal annuli, with no autotomy. The caudal cap is covered with somewhat irregular segments.

The lateral sulci are not strongly marked and there are no dorsal or ventral sulci. There are numerous diagonal folding lines on the dorsal surface of the body.

Locality Records. ANGOLA: Humbe: MB T46-525 (Holotype of *M. anchietae*; Bocage 1873b, 1895; Sternfeld, 1911b; Strauch, 1881). Mupa: LFCM (unnumbered) (Holotype of *M. devisi*, Monard, 1937). Caquindo and Vila da Ponte: LCFM (two unnumbered); NMB 13331 (Syntypes *M. okavangensis* Monard, 1931, 1937).

SOUTH WEST AFRICA: Ruacana: SM 1515. Oshakati: SM 1473, TM 38599. Ondongua: SAM 16123 (FitzSimons, 1943). "Ovamboland": TM 21365, 21367. Kayas: ZMU 35500. "Okavango": HM 4277 (Werner, 1915). Runtu: CAS 106025; SAM 19714a-19714d, 19715a-19715f; TM 28680, 29655, 29657-29658. Bagani: SM 1490. 15 km. WSW of Katima Mulilo: UM 21364, 22998-23008, 23010-23026, 23028, 23029, 23978-23983, 23985; AMNH 112965-112967, Katima Mulilo: CG 4342-4343, 4351-4352, 4354, 4358; TM 43706; UM 24246-24248. Otjovasandu: SM 1713. Southern Kaokoveld: FMNH 77609. Neitsas Farm: HM 3439 (Werner, 1910b, *not* paratype *M. quadriscutata*; Werner, 1915; Sternfeld, 1911b). Waterberg: MCZ 39907 (Loveridge, 1941). TM 16937 (FitzSimons, 1938, 1943). Otjosomgombe: BM 1936.9.4.37, 1936.9.4.39. Otjarondyupa: NRM 1671, 1673, 1678-1679. Sukses: SMF 46086 (Mertens, 1955). Rugby: SM 1712. Otjosondu: SM 1524. Okahandja: FMNH 61656-61657, 74073-74075; MCZ 22481; SM 1710; TM 4788-4790 (Fitz-Simons, 1943). Gravelotte: TM 39129. Ka-lidona: SMF 46277 (Mertens, 1955). *No locality*: FMNH 62786; HM 3440a-3440b.

BOTSWANA: Khwai: UM 20152, 28202-28210. Shorobe: UM 20135, 20806-20807. 40 km. W of Ghanzi: UM 13023. *No locality*: SAM (two unnumbered).

Monopeltis leonhardi Werner
Figures 10, 20, 23-29, 41-44

Monopeltis leonhardi Werner, 1910a, p. 328. *Terra typica*: "Kalahari, zwischen Kgokong

und Kang," Botswana. Holotype: ZMU 23201.

Monopeltis vernayi FitzSimons, 1932, p. 36. *Terra typica*: "Gomodimo, Central Kalahari," Botswana. Holotype: TM 14468.

Diagnosis. A medium-sized (200 to 290 mm. snout-vent length in adults) species of *Monopeltis* with the dorsal surface heavily pigmented from nape to tail tip and this coloration extending below the lateral sulcus. The species has 170 to 213 body, three or four (rarely five to seven) lateral, and five to nine caudal annuli (up to the bluntly rounded tip), 17 to 34 dorsal plus 14 to 27 ventral segments to a midbody annulus, and two to four (usually four) first and three to 11 second postgenial segments. The azygous head shields are paired, the ocular being wedged between them. There are no preoculars. The nasals are short and do not contact the oculars, the lip, or each other. There are four to seven (usually six) parietal shields. The pectoral zone is rectangular and the sutures between the six (very rarely four) shields are parallel. They correspond to four dorsal body annuli, except when the lateral ones are broken up. The ventral segments of the prepectoral annulus are slightly enlarged but not involved in the pectoral shields. The lateral sulci are clearly expressed, but neither dorsal nor ventral sulci are obvious. Diagonal folding lines occur. There are two to 22 super-numerary dorsal half-annuli, most of these corresponding to the first 50 body annuli. The dorsal interannular sutures cross the body at right angles to its long axis. There are no precloacal pores. No autotomy occurs.

Description. This is a medium-sized species of *Monopeltis* with the available specimens ranging from 90 to 290 mm. in snout-vent length (fig. 20). The dorsal surface from nuchal region to tail tip is heavily pigmented grayish or reddish brown, the pigmentation extends for two or three segments ventral to the lateral sulcus and a little farther along the interannular sutures. There are often extensive areas of pigmentation on the large azygous head shields, but the mid-ventral surface is unpigmented. The areas of densest pigmentation tend to be the nuchal region and the dorsal surface of the tail. Juveniles are less strongly pigmented.

The dorsal surface of the head is divided into two azygous shields. The dorsal region of the
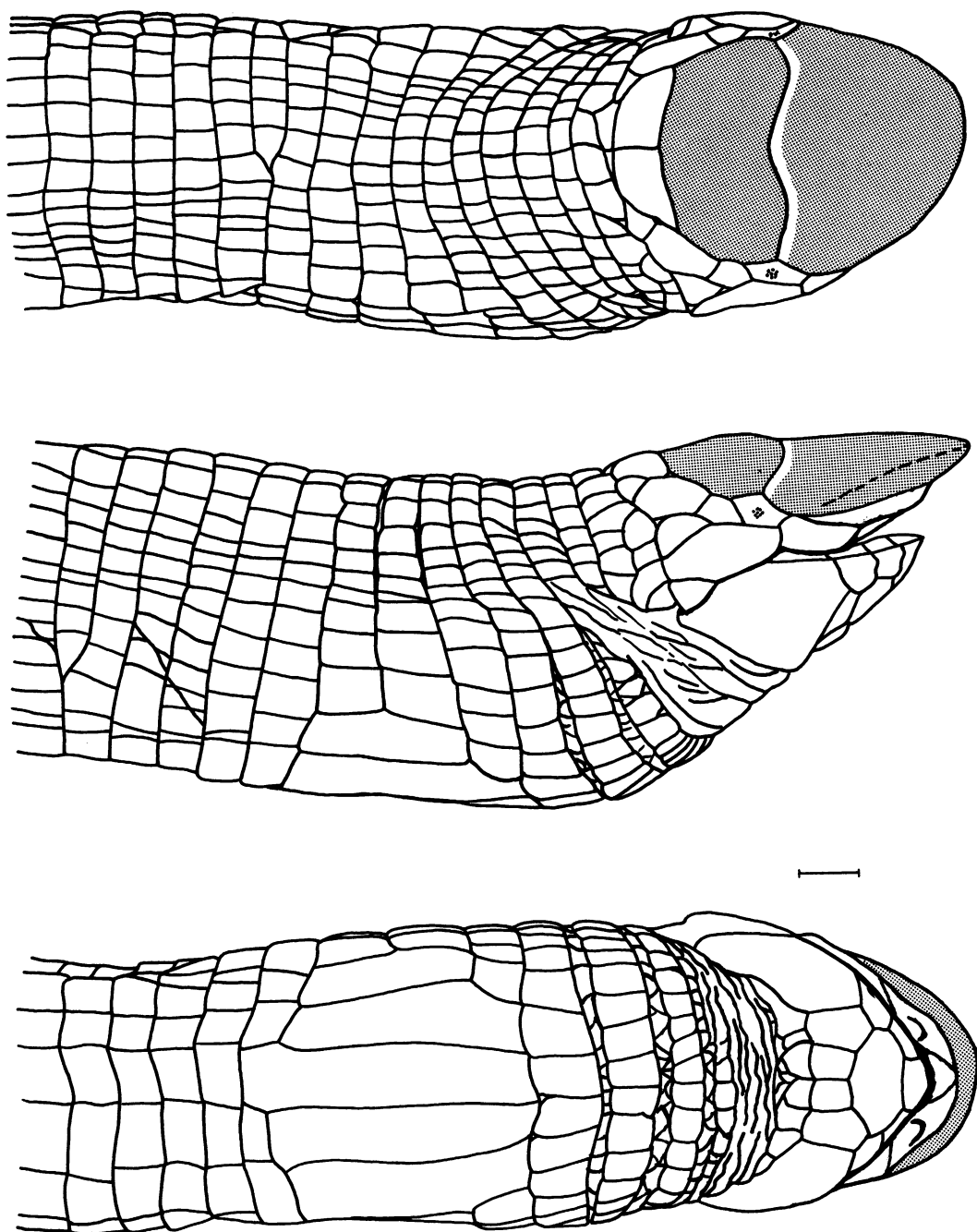
FIG. 41. *Monopeltis leonhardi.* Pattern of head scalation. Dorsal, lateral, and ventral views of head and pectoral region of NMSR 1896 from Bulawayo Airport, Rhodesia. The line equals 1 mm. to scale.

anterior head shield is slightly concave and that of the posterior shield is convex.

The eye is usually visible as a dark spot beneath the lozenge-shaped ocular, which usually

makes contact with the second supralabial and is bordered posteriorly by a small postocular. A series of four to seven (usually six) parietal shields links the third supralabials and separates the posterior azygous head shield from the first body annulus.

The nostrils are crescent-shaped and inserted in relatively short nasal scales, which are well separated from the oculars, the lip, and each other. There are three supralabials, the third by far the largest.

The lower jaw is formed by a somewhat
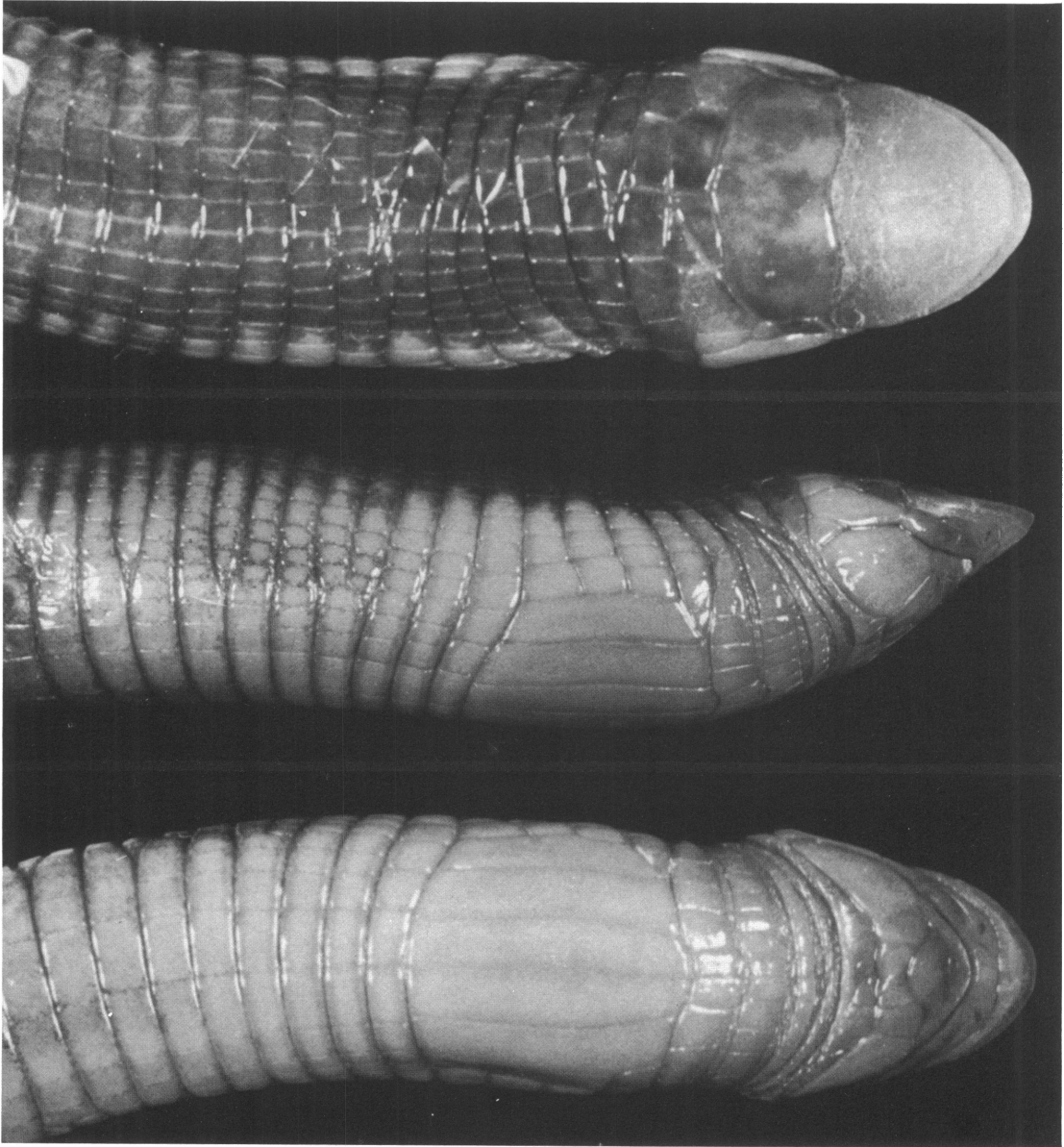
FIG. 42. *Monopeltis leonhardi.* Dorsal, lateral, and ventral views of UM 22474 from Lekuru Pan, Botswana. Note dorsal pigmentation, regularly rectangular pectorals and supernumerary dorsal half-annuli.
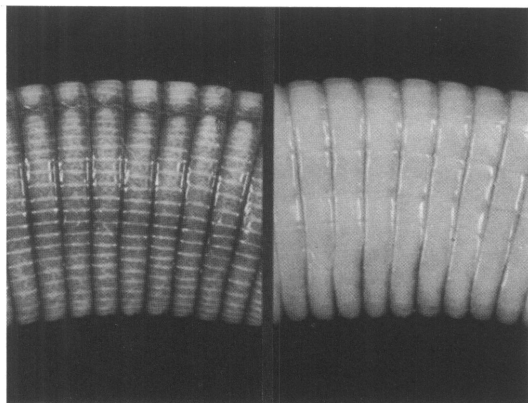
FIG. 43. *Monopeltis leonhardi.* Left, dorsal view, and right, ventral view at midbody to show segment arrangement and pigmentation of UM 22474 from Lekuru Pan, Botswana.

squarish mental, the first, second, and enormous third infralabials, and the enlarged shield-shaped postmental (genial). Posterior to the postmental are two (rarely one) pairs of first postgenials; the medial pair are in contact (sometimes fused) behind the postmental, the lateral pair are in contact with the second infralabials. Immediately caudad to the first row of postgenials is a second row of three to 11 postgenial segments; the larger medial ones border the first postgenials, and the tiny lateral ones border the third infralabials posteriorly.

The modified pectoral region extends to the seventh through the eleventh dorsal annulus; there are usually six elongate rectangular pectoral shields (the lateral pair may be more or less broken up); these correspond to four dorsal half-annuli. The midventral segments of the prepectoral annulus are slightly enlarged, but are not involved with the pectoral shields.

There are 170 to 213 body annuli from the posterior edge of the third infralabial up to (but not including) the precloacal shields. There are two to 22 supernumerary dorsal half-annuli. Most of these correspond to the first 50 body annuli, although there is usually one extra half-annulus in the precloacal region. A midbody annulus has 17 to 34 dorsal plus 14 to 27 ventral segments. The middorsal segments are approximately three times as long as wide and the mid-

ventral segments three times as wide as long. The number of dorsal segments is consistently greater than the number of ventral segments for any given specimen.

There are generally three or four (rarely five to seven) lateral annuli, the first one or two in contact with the outer of two or three pairs of enlarged precloacal shields. There are no precloacal pores.

The short subcylindrical tail is smoothly rounded. There are five to nine caudal annuli, with no autotomy. The caudal cap is covered with somewhat irregular segments.

The lateral sulci are well marked, but there are no dorsal or ventral sulci. There are diagonal folding lines on the dorsal surface of the body.

Locality Records. SOUTH WEST AFRICA: Southern Kaokoveld: FMNH 74077. Waterberg: AMNH 57613-57615, HM 2893a-2893e, MCZ 39908-39909; ZMU 35499 (Loveridge, 1941). Otjosongombe: BM 1936.9.4.38. Otjorondyupa; NRM 1972; Okahandja: FMNH 74076; SMF 46085, 66087 (Mertens, 1955, 1971). Windhoek: SM 1714. Labora Farm: TM 33229-33231. Kalidona: SMF 46278 (Mertens, 1955). Gobabis: MCZ 21030 (not Paratype of *M. leonhardi*; Barbour and Loveridge, 1929).

SOUTH AFRICA: *Cape Province.* Tierkop: MMK (unnumbered) (FitzSimons, 1943). Kalahari Gemsbok National Park: TM (tail only—from stomach of *Canis mesomelas*); (FitzSimons and Brain, 1958). *Transvaal*: Kruger National Park, western boundary north of Mutale River: *NKW/NP 48A-48F (six specimens).

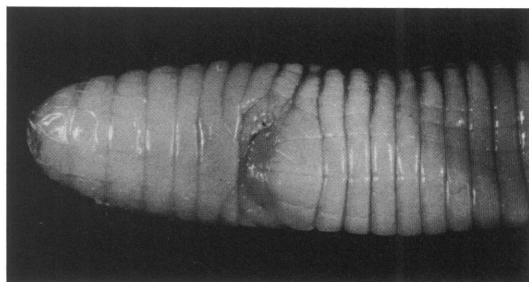BOTSWANA: Ghanzi: UM 13022. Xade Pan:

FIG. 44. *Monopeltis leonhardi.* Ventral view of cloaca and tail of UM 22474 from Lekuru Pan, Botswana.

UM 11312. Gomodimo Pan: TM 14468 (Holotype of *M. vernayi* FitzSimons, 1932, 1935, 1943; Loveridge, 1941). Kgokong to Kang: ZMU 23201 (Holotype of *M. leonhardi*, Werner, 1910). Kangyane Pan: UM 13026-13031, 13043-13046. 40 km. S of Tshane UM 22158-22160. 55 km. S of Tshane: UM 22350-22352. Lekuru Pan: UM 22471-22476. 22 km. N of Mabua Sehubi Pan: AMNH 119972-119975; UM 22579, 22581, 22582, 22585-22590. 30 km. NE of Tshabong: UM 13061. Francistown: UM 12488, 18103. Tonoto: UM 12489. Palapye Road: SAM 10352 (Boulenger, 1910; FitzSimons, 1943, fig. 296-300).

RHODESIA: Wankie National Park, Hendriks Pan: UM 28333-28336, Dandari Pan: UM 28328-28331, Pongoro: 22106-22109. Dahlia: UM 546 (Broadley, 1962). Lupane District: UM 2717. Lupane: UM 2718. Teakland: *UM 31598. Sawmills (Nyamandhlovu District): NMSR 672 (Broadley, 1962). Bulawayo Airport: NMSR 1896 (Broadley, 1962). Malugwe Pan: UM 12201. *No locality*: CG 4783.

Biological Miscellanea. Taken at Gomodimo in a typical Kalahari sand veld while excavating gerbil holes; at Waterberg in moist loamy soil under stone at foot of mountain (FitzSimons, 1938). Kalahari Gemsbok Park specimen from stomach of jackal *Canis mesomelas.*

Monopeltis capensis A. Smith
Figures 6, 14-22, 45-59

Monopeltis capensis A. Smith, 1848 (1834-1849), pl. 67. *Terra typica*: "24° lat. S.," South Africa; here corrected to "southwestern Transvaal." Syntypes: BM65.5.5.179: RR-1946.8.31.96, RR1946.8.31.97 (see FitzSimons, 1937a, p. 267).

Monopeltis decosteri Boulenger, 1910, p. 495. *Terra typica*: "Delagoa Bay" (=Lourenço Marques), Mozambique. Holotype: SAM 650.

Diagnosis. A medium-sized (160 to 340 mm. snout-vent length in adults) species of *Monopeltis* with the dorsal surface immaculate or with pigmentation largely restricted to the posterior half of the body and tail. The species has 172 to 221 body, three to six lateral, and seven to 11 caudal annuli (up to the bluntly rounded tip), 13 to 33 dorsal plus 10 to 32 ventral segments to a midbody annulus, and two to five (usually two or four) first and two to 11 second postgenial segments. A few (mostly juvenile) specimens have discrete head shields and adults from some areas tend to retain blind lateral sutures, but the majority of specimens have completely fused head shields, with or without a lateral indentation for the ocular. There are no preoculars. The nasals are well separated from the oculars and from each other, they may border the lip or be well separated from it. There are four parietal shields. The pectoral zone is rectangular and the sutures between the four to six shields are roughly parallel. The lateral pair corresponds to fewer dorsal annuli than do the medial pairs and may be broken up completely. The ventral segments of the prepectoral annulus are enlarged, but not involved in the pectoral shields. The lateral sulci are clearly expressed, but neither dorsal nor ventral sulci are obvious. Diagonal folding lines occur. There are usually numerous supernumerary dorsal half-annuli, most of these corresponding to the first 50 body annuli, a few specimens have negative numbers. The dorsal interannular sutures cross the trunk at right angles to its long axis. Usually two precloacal pores lie on small segments lateral to the precloacal shields. No autotomy occurs.

Monopeltis capensis capensis Group A
Figures 45-47

Description. This is a medium-sized form of *Monopeltis* with the available specimens ranging from 108 to 303 mm. in snout-vent length (fig. 20). All specimens are unpigmented.

The dorsal surface of the head is usually covered by a single azygous head shield, notched laterally to accommodate the oculars. Only one specimen has two discrete head shields, but 34 have blind lateral sutures. The dorsal region of the head shield is usually slightly concave anteriorly and convex posteriorly in profile.

In juveniles the eye may be visible as a dark spot beneath the ocular, which is lozenge-shaped and usually makes contact with the second supralabial anteriorly and the outer pair of parietals posteriorly.

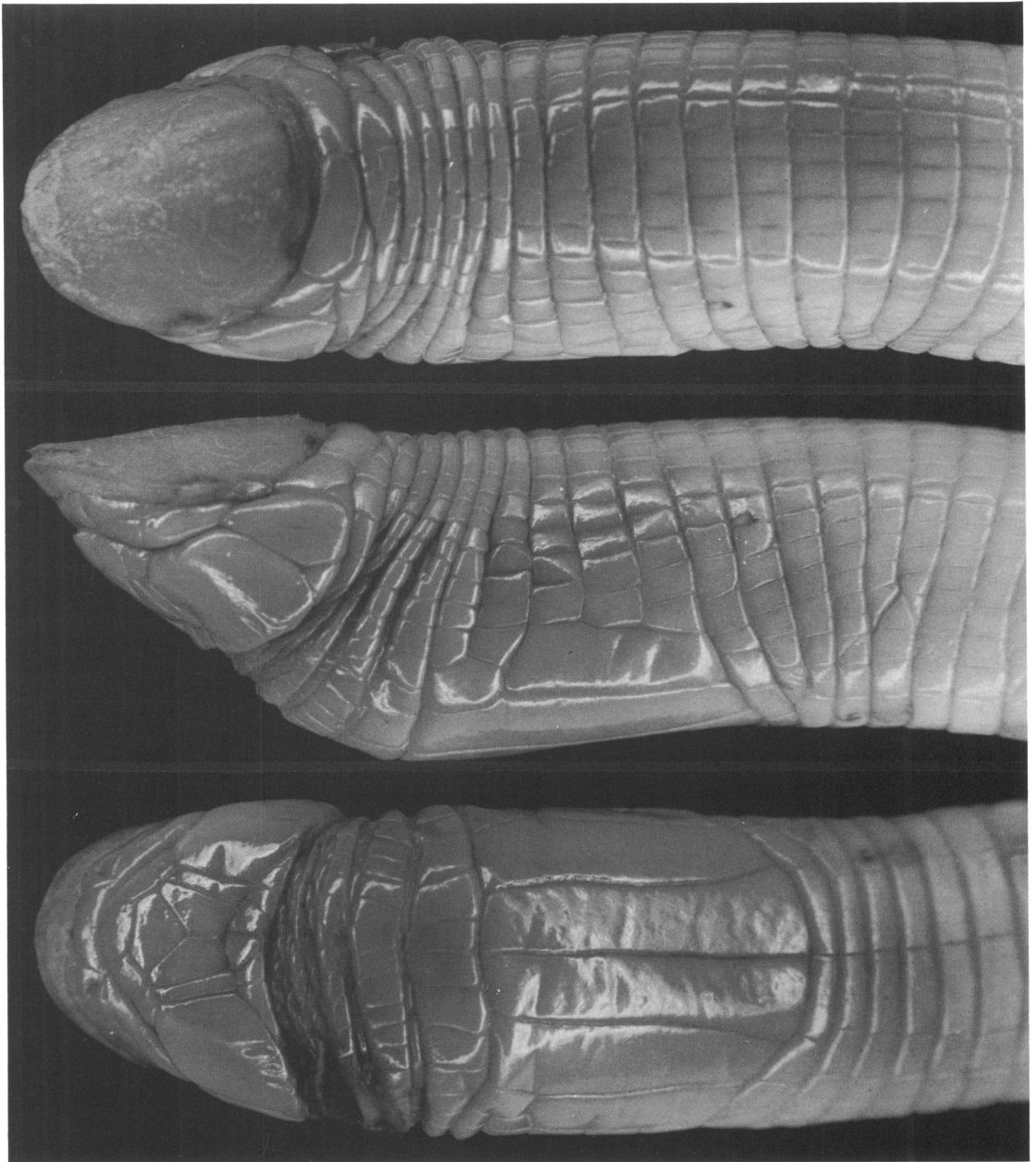A row of parietals separates the large head

FIG. 45. *Monopeltis capensis capensis* (var. A). Dorsal, lateral, and ventral views of head of CG 4809 from Bothaville, Orange Free State.

shield from the first body annulus; it usually consists of four to six shields, the medial pair by far the largest.

The nostrils are crescent-shaped and inserted into moderate nasal scales which may narrowly contact the lip, but are well separated from the oculars and each other. There are almost always three supralabials, the third being the largest.
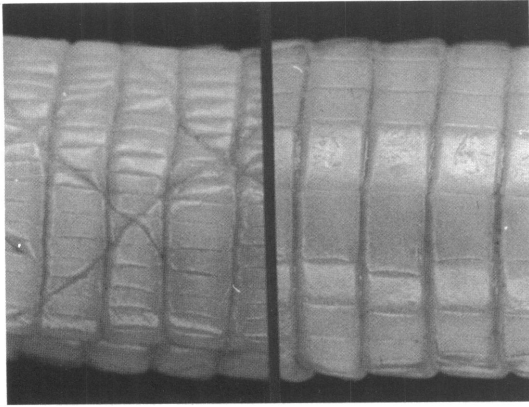
FIG. 46. *Monopeltis c. capensis* (var. A). Left, dorsal view, and right, ventral view at midbody to show segment arrangement and pigmentation of CG 4809 from Bothaville, Orange Free State.

The lower jaw is formed by a pentagonal mental, the first, second, and enormous third infralabials, and a large shield-shaped postmental (genial). Posterior to the postmental there is usually a single pair of large first postgenials (but three to five shields occasionally occur), followed by four to 11 (the mode is 7) small second postgenials, which extend for some distance behind the third infralabials.

The modified pectoral region extends to the eighth to eleventh dorsal annulus, there are usually six elongate pectorals, the medial pair slightly narrowed anteriorly and projecting slightly forward, so that the midventral segments of the prepectoral annulus form a short radius curve around them. The outer pair of pectorals may be more or less broken up into the four or five constituent segments.

There are 176 to 210 body annuli from the posterior edge of the third infralabial up to (but not including) the precloacal shields. There are six to 32 supernumerary dorsal half-annuli, most of these corresponding to the first 50 body annuli, although there are usually one or two extra half-annuli in the precloacal region. A midbody annulus has 18 to 32 dorsal plus 16 to 29 ventral segments. The middorsal segments are approximately three times as long as wide and the midventral segments are approximately one to one and a-half times as wide as long. The number of dorsal segments is equal to or only

slightly greater than the number of ventral segments for any given specimen.

There are three to six (usually four) lateral annuli, the first one contacting the two enlarged medial precloacal scales and the terminal segments usually bearing a pair of precloacal pores (rarely two pairs). There are two (rarely three) pairs of precloacal scales.

The short tail is smoothly rounded and appears subcylindrical in cross section; there may be some flattening of the dorsal surface. There are five to 11 caudal annuli, with no autotomy. The caudal cap is covered with somewhat irregularly fused segments.

The lateral sulci are distinct, but there are no dorsal or ventral sulci. There are numerous diagonal folding lines on the dorsal surface of the body and these may extend ventral to the lateral sulci.

Locality Records. SOUTH AFRICA: *Cape Province*: Vryberg: AMG 6701a-6701c, 6733 (FitzSimons, 1943). Barkly West: (Hewitt & Power, 1913; FitzSimons, 1943). Secretaris: (FitzSimons, 1943). Rooidam: CG 4830-4841. 30 km. W of Kimberley: KM/F 283. Kimberley: AMG 1026; AMNH 18219, 31670-31671; KM/F 286; MCZ 123991, 21320-21323; NMP 1430 (FitzSimons, 1943). Kareeboom, near Kimberley: (Hewitt & Power, 1913). Modder River: (FitzSimons, 1943). Fort Richmond: MCZ 21324; NMP 123a-123b (Hewitt & Power, 1913; FitzSimons, 1943).

Orange Free State: Bothaville: CG 4453-4454 (4456-4457), 4473, 4788-4817; TM 4335 (FitzSimons, 1943; Gans & Wever, 1972; Wever & Gans, 1973). Reitleuil Farm, Bothaville: TM 39646-39647. Richmond West Farm, Bothaville:

FIG. 47. *Monopeltis c. capensis* (var. A). Ventral view of cloaca and tail of CG 4809 from Bothaville, Orange Free State.

TM 39648. Kroonstad: AMNH 47736. Oden-daalsrus: CAS 111650-111651, 111657; CG 3466, 4846-4856, 4858-4892, 4936-4947; TM 16725-16727. Brandfort: CG 4844-4845. Kru-gersdrift Dam: NMBO 386-390. Glen: (Fitz-Simons, 1943). Kelly's View: NMBO 214-219; TM 19387-19390 (FitzSimons, 1943). Bloem-fontein: ZMA 10152a-10152c, NMBO 221-224, 514; RMNH 7083a-7083g; TM 575. Bainsvlei: NMBO 213, 227 (FitzSimons, 1943). Rietspruit: NMBO 226. Rhenosterspruit: NMBO 220. *No locality*: NMBO 250.

Transvaal: Andalusia: TM 22237-22238. Schweizer Reneke: TM 2353 (FitzSimons, 1943). Bloemhof: TM 21789. Wolmaransstad: NMSR 1185; TM 698, 743 (FitzSimons, 1943). Maquas-si: ZMA 11428a-11428f; CG 4893-4900; NMP 1018a-1018b; TM 16137-16138, 21054-21058, 21060 (FitzSimons, 1943). Klipkuil Farm, Ma-quassi: ZMA 10181a-10181f; BM 1936.10.11.1-1936.10.11.6; MCZ 42384-42388, 123992; SAM 18848; TM 16376-16378 (Loveridge, 1941). Leeudoringstad: UM 30243-30245. "24° lat. S" (Limpopo River), more likely southwestern Transvaal (Kirby, 1965): BM 65.5.5.179 (RR 1946.8.31.96 and 1946.8.31.97) (Syntypes of *M. capensis* A. Smith, 1848; Gray, 1865, 1872, 1873; Boulenger, 1885; FitzSimons, 1937a).

BOTSWANA: 10 km. N of Matebe: UM 11055-11056, 11276.

No Locality: CG 3471-3472, 3521-3522; NMB 8914, 9244-9245.

Monopeltis capensis capensis Group B
Figures 48-51

Description. This is a medium-sized form of *Monopeltis* with the available specimens ranging from 90 to 340 mm. in snout-vent length (fig. 20). Pigmentation normally extends from nuchal region to caudal tip but is patchy and anteriorly there is often a mosaic of pigmented and unpigmented segments; some specimens show little or no pigmentation on the anterior quarter of the body. The head is always unpigmented. Pigmentation rarely extends ventral to the lateral sulci, but may cover the midventral segments of the tail.

The dorsal surface of the head is covered by two discrete azygous head shields in some juve-niles, but they are fused in most adults, many of them retaining short, blind lateral sutures. There is usually a lateral notch to accommodate the ocular. The dorsal region of the head shield is usually feebly convex, but may be slightly concave anteriorly in profile.

In juveniles the eye is visible as a dark spot beneath the elongate ocular, which is usually in contact anteriorly with the second supralabial and posteriorly with the parietals; there may be a small triangular subocular. A row of four to six parietals separates the large head shield from the first body annulus. The nostrils are crescent-shaped and are inserted into moderate nasal scales, which are separated from the oculars, the lip (sometimes in short contact), and each other. There are almost always three supralabials, the third by far the largest.

The lower jaw is formed by a squarish mental, the first, second, and enormous third infralabials and a large shield-shaped postmental (genial), which is occasionally longitudinally bisected. Posterior to the postmental there are usually two pairs of anterior postgenials, followed by four to 11 (usually seven or eight) small second post-genials. The modified pectoral region extends to the seventh through the eleventh dorsal annulus; there are usually six elongate pectorals, the medial pair narrowing anteriorly and projecting slightly forward, so that the midventral segments of the prepectoral annulus form a short radius curve around them. The outer pair of pectorals may be more or less broken up into the four or five constituent segments or partially fused with the adjoining pectorals.

There are 179 to 220 body annuli from the posterior edge of the third infralabial up to (but not including) the precloacal shields. There are three to 27 supernumerary dorsal half-annuli; most of these correspond to the first 50 body annuli, although there are often one or two extra half-annuli in the precloacal region. A midbody annulus has 19 to 33 dorsal plus 14 to 32 ventral segments. The middorsal segments are approxi-mately three or four times as long as wide and the midventral segments may be from one and a-half times as long as wide to one and a-half times as wide as long. The number of dorsal seg-ments is subequal to or only slightly greater than the number of ventral segments for any given specimen.
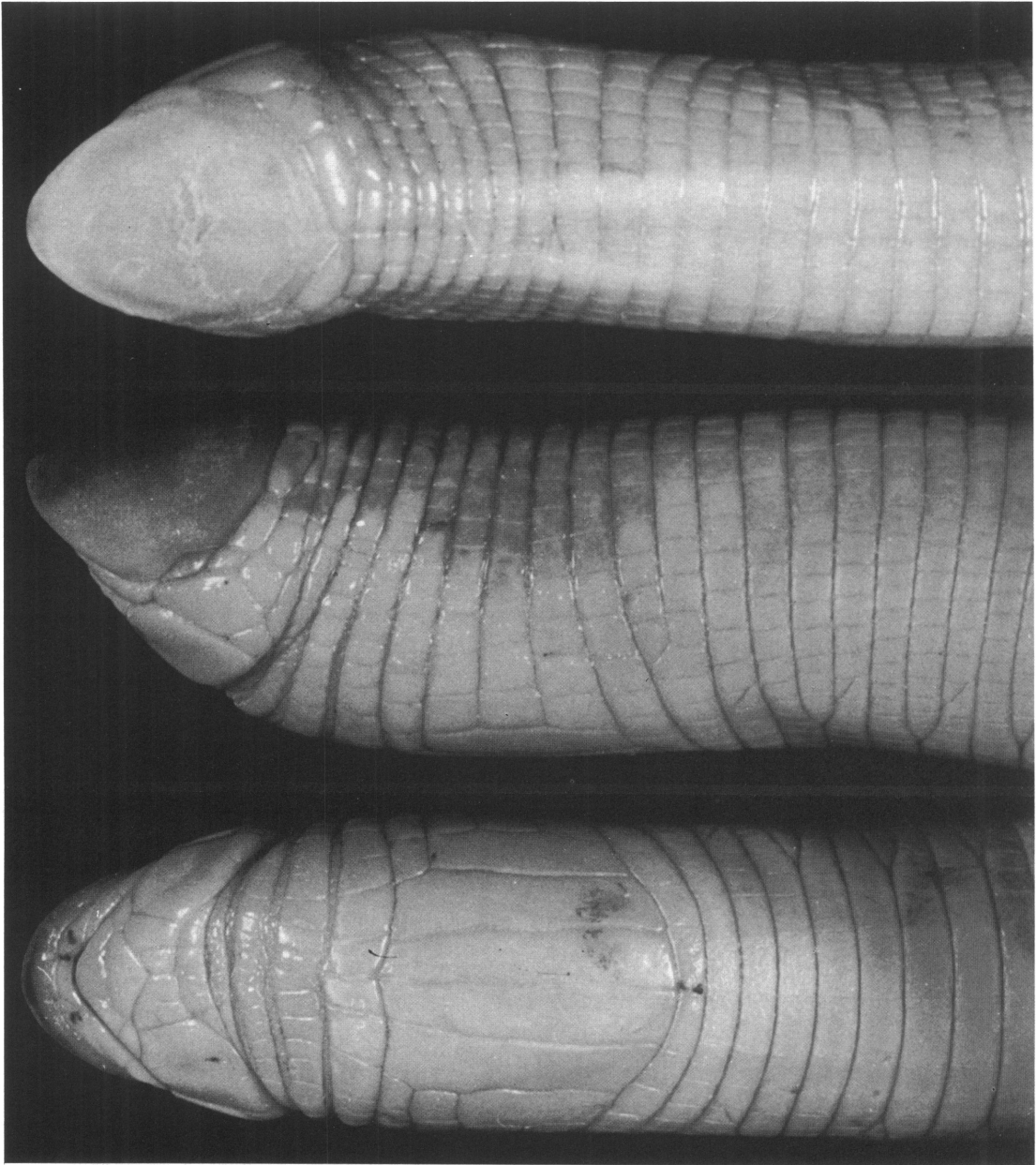
There are three to six (usually four) lateral

FIG. 48. *Monopeltis capensis capensis* (var. B). Dorsal, lateral, and ventral views of head of ZMU 5701 from Otjimbingue, South West Africa.

annuli, the first one contacting the two enlarged medial precloacal shields and the terminal (rarely penultimate) segments usually bearing a pair of precloacal pores.

The short tail is smoothly rounded and appears subcylindrical in cross section. There are four to 11 caudal annuli, with no autotomy. The caudal cap is covered with irregular segments.

The lateral sulci are distinct, but there are no dorsal or ventral sulci. There are numerous
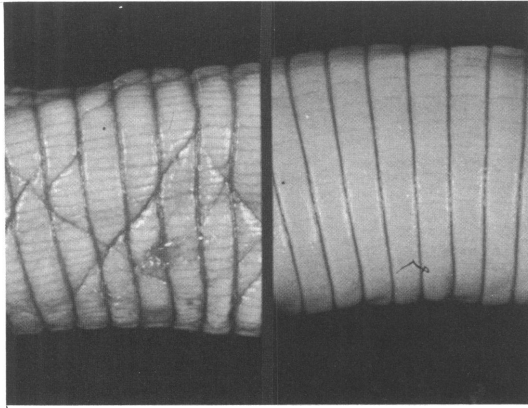
FIG. 49. *Monopeltis c. capensis* (var. B). Left, dorsal view, and right, ventral view at midbody to show segment arrangment and pigmentation of ZMU 5701 from Otjimbingue, South West Africa. Note deep diagonal sutures.

diagonal folding lines on the dorsal surface of the body.

Locality Records. ANGOLA: Humbe: MB 524a-524b; SMF 26481; ZMU 9000a-9000b (Syntypes of *M. sphenorhynchus* Peters, 1879, 1882; Bocage 1873a, 1895, 1896 [(not Inhambane), 1897]). "Tumbo" (?= Tumbole River): ZIL 9351. Sturuba: NMW 12348. *No locality*: AMG 1902.

SOUTH WEST AFRICA: Grootfontein: HM 4276 (Werner, 1915). Outjo: ZMU 25078 (Sternfeld, 1911a). Omatjenne: AMG 6411; MCZ 34884; TM 16174 (FitzSimons, 1943). Hoasas: SM 1705. Waterberg: AMNH 57616; ZFMK - H (unnumbered). Waterberg District: AMG 956. Ombujomatemba: BM 1937.12.3.75-1937.12.3.89; MCZ 43151-43158 (Loveridge, 1941). Omaruru: SMNH 1674-1675 (Peters, 1869). Okahandja: FMNH 57629, 61655, 62787, 64497, 75708-75711, 80020-80033; SM 1707; SMF 46087-46088, 46696; 50622, 51532 (Mertens, 1955, 1971); TM 36073-36074; ZMU 23202 (Sternfeld, 1911b). Hochland von Okahandja: ZSM 24/60. Teufelsbach: AMG 7319 (FitzSimons, 1943). Kalidona: SMF 46567, 51042 (Mertens, 1955, 1971). Ovikokorero: HM 3667. Otjimbingue: ZMU 5701 (Peters, 1867; Sternfeld, 1911b). Windhoek: SM 1703, 1715 (Sternfeld, 1911b). 25 km. S of Windhoek: JV 8017.

Gochagenas: SM 1706. Zwischen Aub & Klein Nauas: ZMU 23401 (Nieden, 1913). Eava Farm: SM 1704, 1711, 1716. Gobabis: ZMU 23894 (Sternfeld, 1911a). Rehoboth: BM 1936.8.1.645 (Parker, 1936). Ababis: HM 3651. Gibeon, Fish River: SMNS 2488. Mersa Farm: SMF 40689 (Mertens, 1955). Bethanie(n): ZMU 23447. Namaqualand: SAM 1766-1767. *No locality*: BM 1936.8.1.646-1936.8.1.647 (Angola or S.W.A.): ZMU 26709, 28455; ZSM 346/1920.

SOUTH AFRICA: *Cape Province*: Lower Molopo: (Hewitt & Power, 1913; FitzSimons, 1943). Aughrabies Falls: TM 36746, 37490. Alhut: TM 29815. Kakamas: (FitzSimons, 1943). Vroupan: TM 26810. Hopetown: TM 26806.

Transvaal: Weipe Farm: TM 41557-41560, 41769, 43152-43153. Rochdale Farm: TM 30132. Kruger National Park (Pienaar, 1966) —Hlanganine firebreak: NKW 196. Olifants River: NKW 212a-212c. Olifants River to Mangwe Induna: NKW 28, 56a-56b, 57a-57b. Olifants Camp: *NKW 234. Northam: TM 26747. Rechtuit Farm: TM 1070-1074 (FitzSimons, 1943). Nylstroom: MCZ 21277; TM 1221, 1223 (FitzSimons, 1943, figs. 279-281) Vygeboom: TM 3380, 3382, 3384. Vygeboompoort: FMNH 17450; MCZ 14195-14196; TM 1909, 2219, 2221, 2225, 2227-2229, 2232-2237, 2240-2241, 2473, 12697 (FitzSimons, 1943). Rhenosterpoort: TM 3925-3926. Warmbaths: NMP 1139. Bezuidenhoutskraal: TM 33760. Schildpadfontein, Pretoria: TM 3579. Pretoria District: TM 22181 (FitzSimons, 1943). Wonderboom, Pretoria: (FitzSimons, 1956). Weltevreden, Middelberg District: TM 4559.

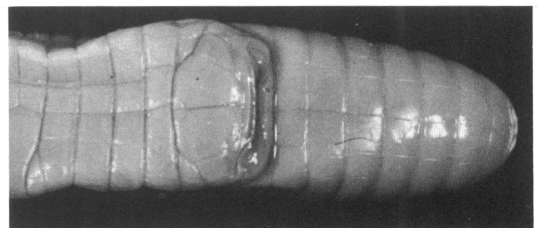BOTSWANA: 40 km. W of Ghanzi: UM

FIG. 50. *Monopeltis c. capensis* (var. B). Ventral view of cloaca and tail of ZMU 5701 from Otjimbingue, South West Africa.
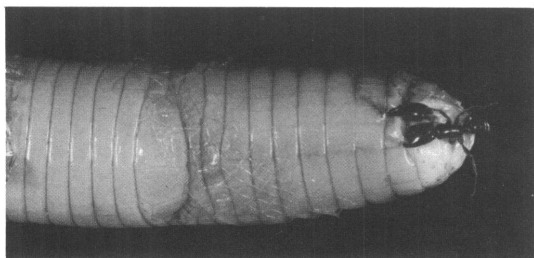
FIG. 51. *Monopeltis c. capensis* (var. B). Ventral view of cloaca and tail of FMNH 80030 from Okahandja, South West Africa. Note the ant with mandibles solidly locked into the tail.

13024-13025. Kuke: FMNH 17268 (*not* paratype of *M. vernayi*) (FitzSimons, 1935; Loveridge, 1941; Marx 1958). Mahalapye: (FitzSimons, 1943). Mabua Sehubi Pan: UM 13047-13050. *No locality*: NMW 12349.

Monopeltis capensis capensis Group C
Figures 52-55

Description. This is a small form of *Monopeltis* with the available specimens ranging from 77 to 290 mm. snout-vent length (fig. 20). Pigmentation is light and originates between body annuli 50-100, tending to become progressively heavier posteriorly. The tail may be densely pigmented above and below, but the caudal tip is unpigmented.

The dorsal surface of the head is always covered by a single azygous shield without lateral blind sutures, but usually with lateral notches to accommodate the oculars. The dorsal region of the head shield is convex in profile.

In juveniles the eye is visible as a dark spot below the elongate ocular, which is usually in contact anteriorly with the second supralabial and posteriorly with the anterior parietals.

A transverse row of four to six parietal shields separates the large head shield from the first body annulus.

The nostrils are crescent-shaped and are inserted into relatively short nasal scales that are well separated from the oculars and each other but usually contact the lip. There are three supralabials, the third being the largest.

The lower jaw is formed by a pentagonal men-

tal, first, second, and enormous third infralabials and a broad shield-shaped postmental (genial). Posterior to the postmental there are usually four first and four to eight (usually five) small second postgenials.

The modified pectoral region extends to the eighth through the tenth dorsal annulus. There are usually six elongate pectorals, the medial pair narrowed anteriorly and projecting forward so that the midventral segments of the prepectoral annulus form a short radius curve around them.

There are 188 to 221 body annuli from the posterior edge of the third infralabial up to, but not including, the precloacal shields. There are two to 28 supernumerary dorsal half-annuli, most of these corresponding to the first 50 body annuli. A midbody annulus has 17 to 31 dorsal and 12 to 23 ventral segments. The middorsal segments are approximately three times as long as wide and the midventral segments are approximately twice as wide as long. The number of dorsal segments is consistently greater than the number of ventral segments for any given specimen.

There are three to five lateral annuli, the first one contacting the two enlarged medial precloacal shields and the terminal segments usually bearing a pair of precloacal pores.

The short tail is smoothly rounded and appears subcylindrical in cross section. There are six to 11 caudal annuli with no autotomy. The caudal cap has ill-defined irregular segments.

The lateral sulci are distinct, but there are no dorsal or ventral sulci. There are numerous diagonal folding lines on the dorsal surface of the body; some of them extend ventral to the lateral sulci.

Locality Records. SOUTH AFRICA: *Transvaal*: Kruger National Park (Pienaar, 1966)— Pafuri: NKW 142. W of Hape Pan: NKW 152. Saselondonga to Pafuri: *NKW (15 specimens); TM 28884-28886. Saselondonga to Malonga Fountain: *NKW (28 specimens). Malonga Fountain: *NKW (2 specimens). Between Mahlakuza and Nwambiya Pans: NKW 184a-184b. Between Nwambiyane and Nwambiya Pans: NKW 132. Niandu Sandveld: *NKW (2 specimens); TM 28864-28865. Nyandu Sandveld to Masbambela: *NKW (13 specimens). Mabambela: *NKW (6 specimens). Pumbe Pan to Olifants
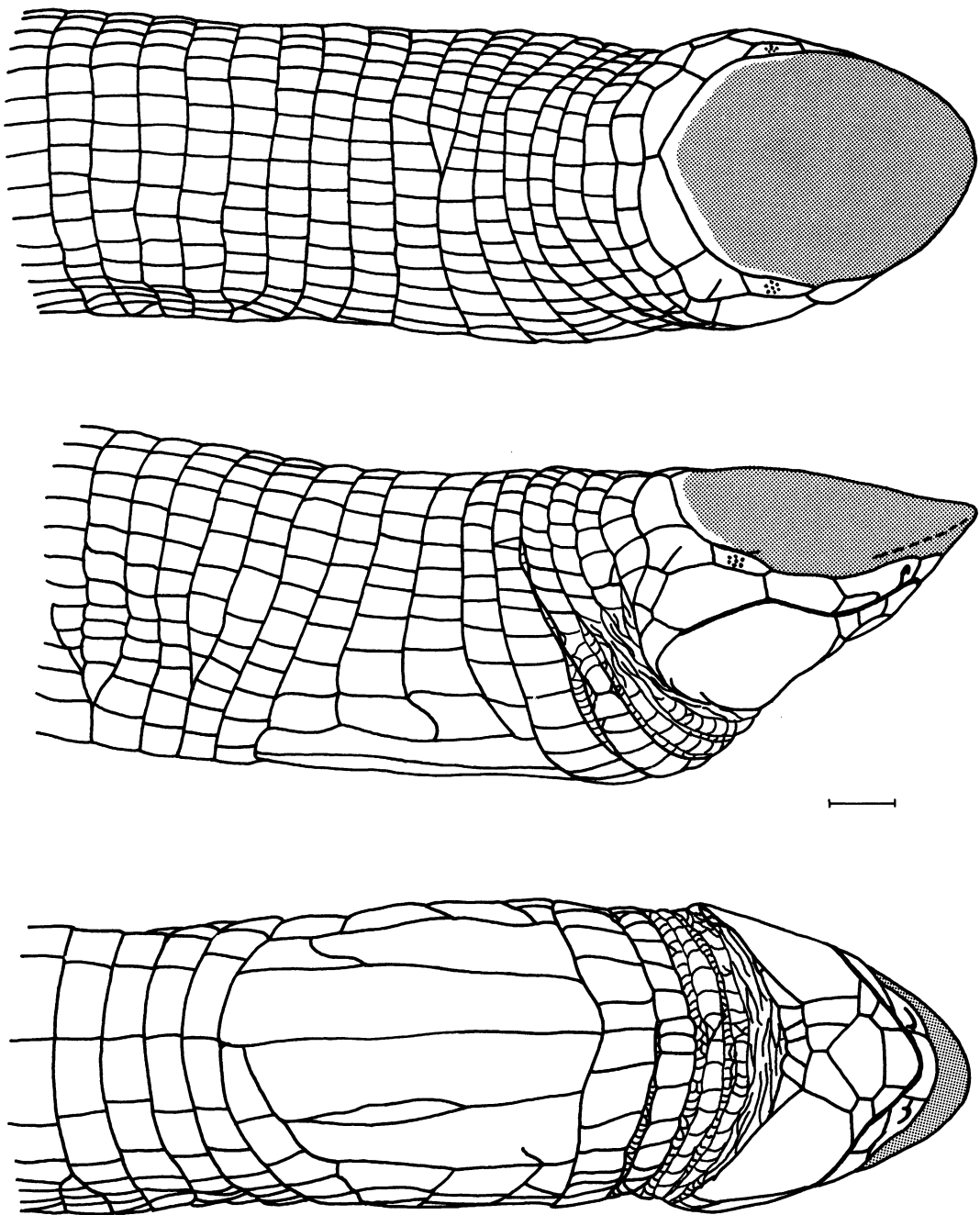
FIG. 52. *Monopeltis capensis capensis* (var. C). Pattern of head scalation. Dorsal, lateral, and ventral views of head and pectoral region of UM 28789 from Matchova, Mozambique. The line equals 1 mm. to scale.

River: *NKW (1 specimen). Pumbe Sandveld: *NKW 232 (14 specimens), 233 (2 specimens), plus 12 duplicate specimens.

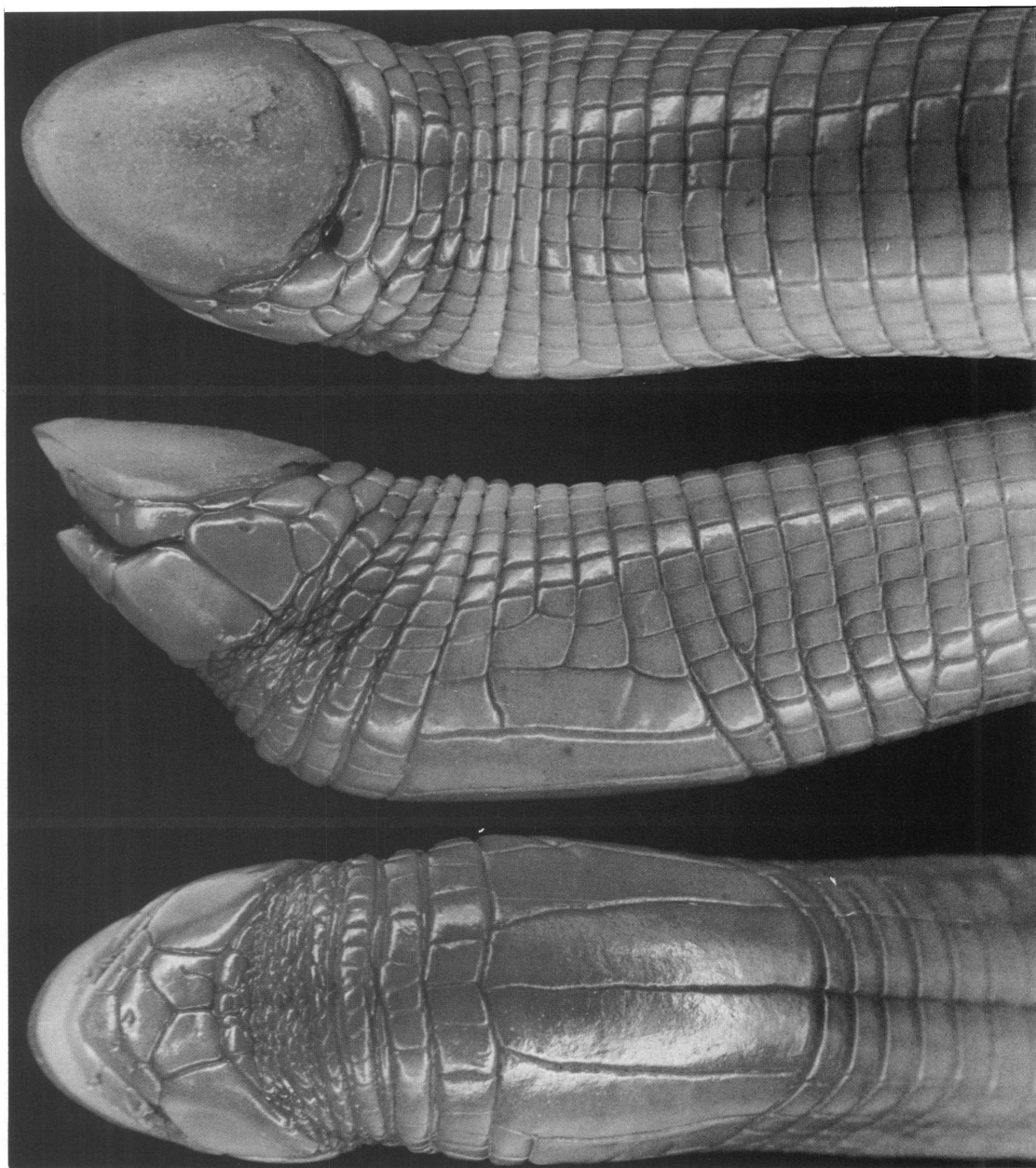RHODESIA: Gonarezhou Game Reserve-Malugwe Pan: UM 12202-12203, 12319-12320, 12238. Gonarezhou Game Reserve-Mabalauta:

FIG. 53. *Monopeltis capensis capensis* (var. C). Dorsal, lateral, and ventral views of head of UM 28792 from Matchova, Mozambique.
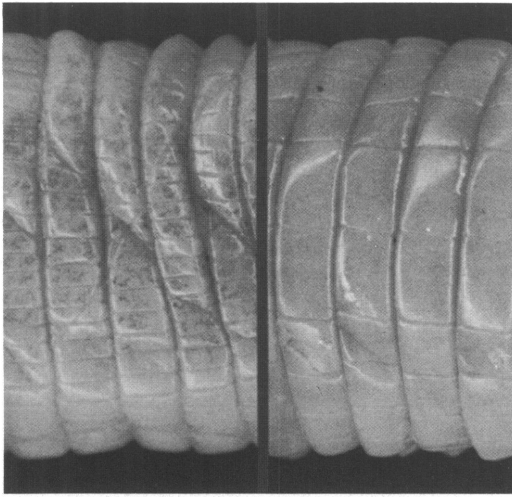
FIG. 54. *Monopeltis c. capensis* (var. C). Left, dorsal view, and right, ventral view at midbody to show segment arrangement and pigmentation of UM 28792 from Matchova, Mozambique.

UM 29953, 29961-29988. Nyala: UM 28115-28123. Vila Salazar: UM 23490. Majinji Pan: UM 20229-20230, 23699-23709. 27371-27372.

MOZAMBIQUE: Morera: UM 25527. Matchova: AMNH 112976-112979; UM 28778-28781, 28783-28812, 28814-28830, 28832, 28833, 28835-28837. "Delagoa Bay" (= Lourenço Marques): SAM 650 (Holotype of *M. decosteri* Boulenger, 1910; FitzSimons, 1937b, figs. 6-9, 1943).

Monopeltis capensis rhodesianus,
new subspecies
Figures 56-59

Holotype: UM 28699, a male collected by J. Mudimu at Nyashanu (altitude approximately 820 m.), Sabi Tribal Trust Land, Buhera District, Rhodesia during November, 1972.

Paratypes: AMNH 112980-112983; UM 28677-28690, 28692-28698, 28700-28710, 28713-28720, 28722-28776; taken with the holotype.

Diagnosis. A race of *Monopeltis capensis* with usually fewer than 12 supernumerary dorsal half-annuli, more than 40 total segments to a midbody annulus, a very tiny or no discrete ocu-

lar segment (if present) lacking contact with the second supralabial, and the tail usually more heavily pigmented than the dorsal surface of the body. Various differences in the relative frequency of character states between this and the nominal race are given in table 8.

Etymology. The name *rhodesianus* refers to Rhodesia from which most of the specimens come.

Description. This is a small form of *Monopeltis* with the available specimens ranging from 90 to 290 mm. in snout-vent length (fig. 20). Pigmentation is usually more or less restricted to the dorsal surface of the posterior half of the body (there may be a few pigmented middorsal segments on the annuli immediately posterior to the parietals), usually becoming heavier on the tail and often extending to cover either the midventral area or the entire tail.

The dorsal surface of the head is always covered by a single azygous shield. Blind lateral sutures are only found in specimens from northwestern Rhodesia and few specimens have lateral notches to accommodate the oculars. The dorsal surface of the head shield is convex in profile.

In juveniles the eye is visible as a dark spot beneath the anterior end of the ocular, which usually fails to contact the nasal and is often very reduced in size or even absent. A row of four parietals separates the head shield from the first body annulus.

The nostrils are crescent-shaped and are inserted in relatively short nasals, which are well separated from the oculars and each other. The nasals may be in broad contact with or well separated from the lip. There are two or three supra-
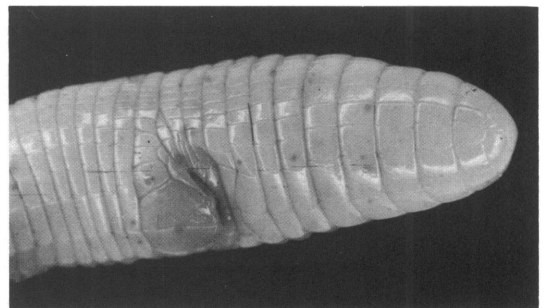

FIG. 55. *Monopeltis c. capensis* (var. C). Ventral view of cloaca and tail of UM 28792 from Matchova, Mozambique.

labials; the first may be fused with the second or with the nasal; the third is the largest.

The lower jaw is formed by a pentagonal mental, first, second (sometimes fused with first),
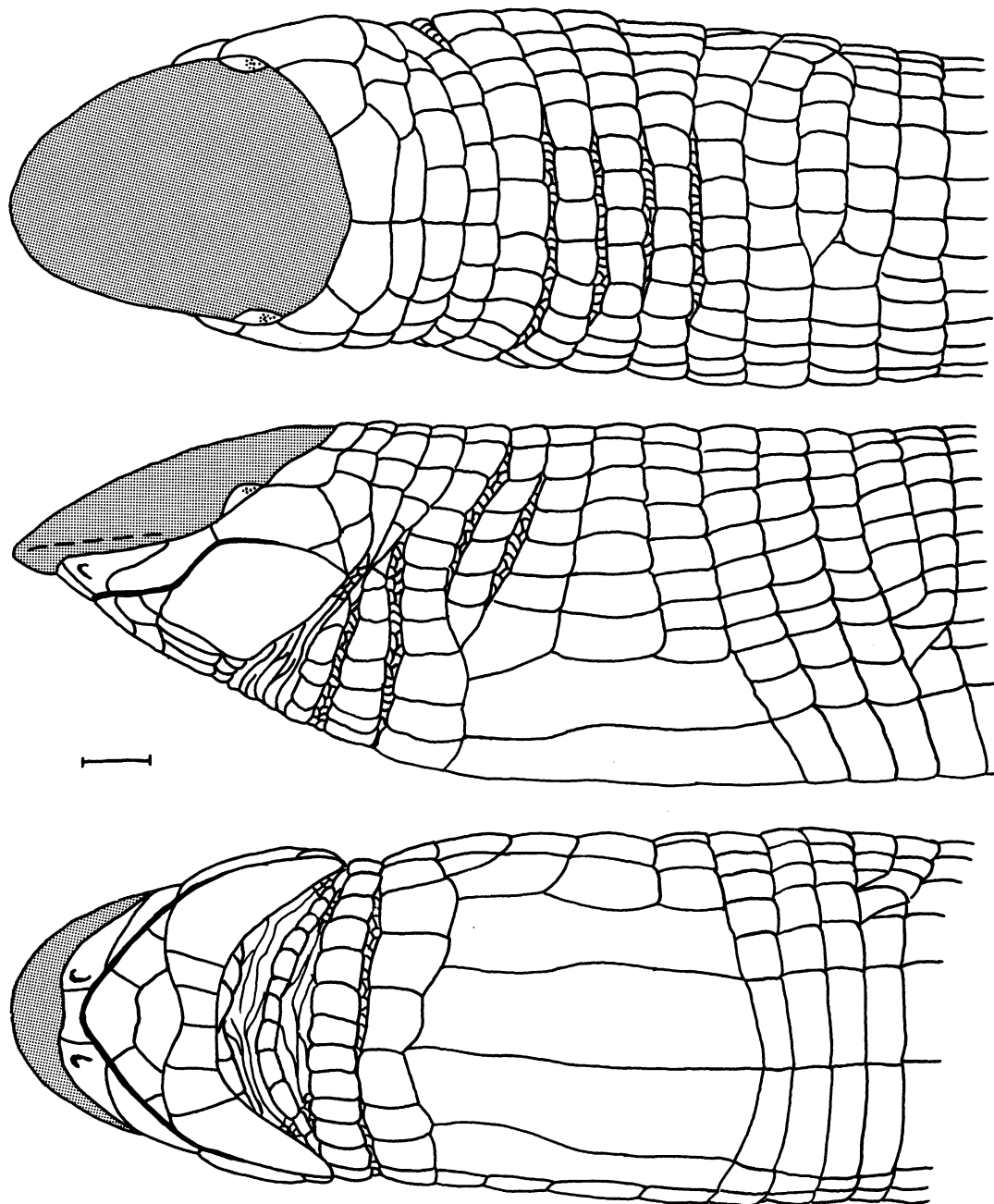
FIG. 56. *Monopeltis capensis rhodesianus.* Pattern of head scalation. Dorsal, lateral, ventral views of head and pectoral region of the paratype UM 28732 from Nyashanu, Rhodesia. The line equals 1 mm. to scale.
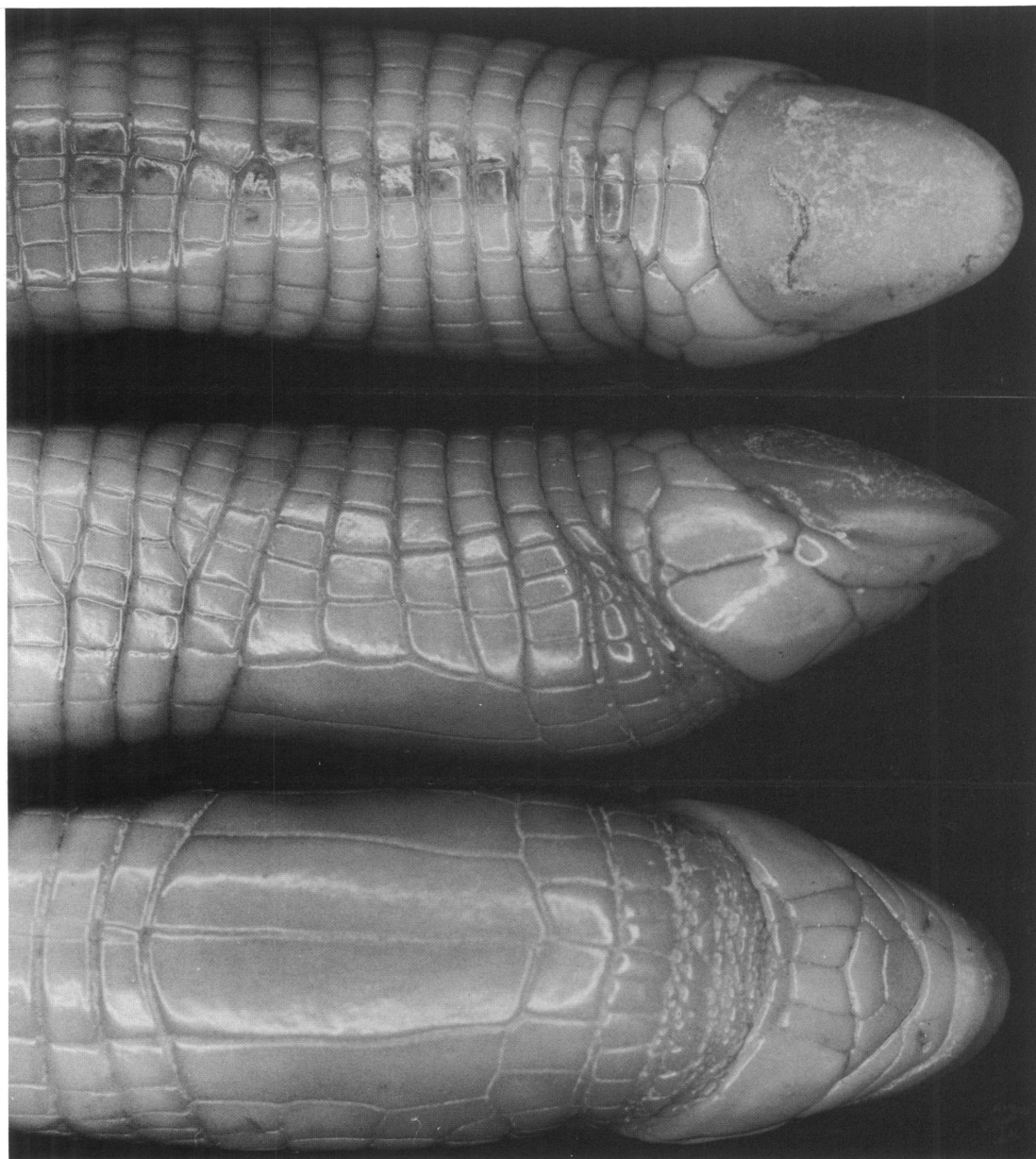
FIG. 57. *Monopeltis capensis rhodesianus*. Dorsal, lateral, and ventral views of head of paratype UM 28732 from Nyashanu, Rhodesia.

and enormous third infralabials and a broad shield-shaped postmental (genial). Posterior to the postmental there are usually four (rarely two or three) first and two to 10 (the mode is 5) second postgenials.

The modified pectoral region extends to the seventh to tenth dorsal annulus; there are usually six elongate pectorals, the medial pair strongly narrowed anteriorly and projecting forward so that the midventral segments of the prepectoral
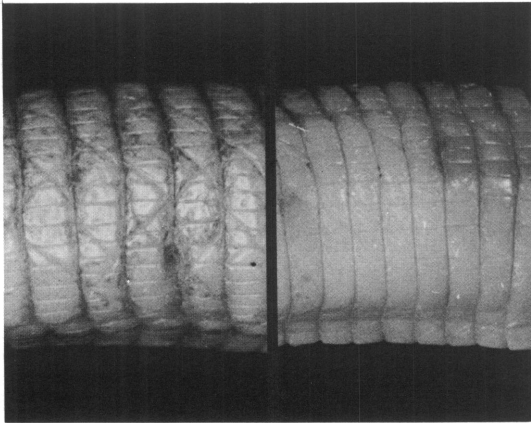
FIG. 58. *Monopeltis c. rhodesianus.* Left, dorsal view, and right, oblique ventral view at midbody to show segment arrangement and pigmentation of UM 25680 from Birchenough Bridge, Rhodesia. Note deep lateral sulcus and diagonal folding lines. The body is slightly deformed.

annulus form a short radius curve around them. The lateral pectorals may be more or less broken up into the four or five constituent segments.

There are 172 to 218 body annuli from the posterior edge of the third infralabial up to, but not including, the precloacal shields. There are not more than 16 supernumerary dorsal half-annuli; most of these correspond to the first 50 body annuli. Most specimens have fewer than 10 and a few even have a reduction (up to six) in dorsal half-annuli. The middorsal segments are approximately two to four times as long as wide and the midventral segments one to three times as wide as long. The number of dorsal segments is subequal to or slightly greater than the number of ventral segments for any given specimen.

There are three to five lateral annuli, the first one contacting the two enlarged medial precloacal shields and the terminal segments bearing a pair of precloacal pores.

The short tail is smoothly rounded and appears subcylindrical in cross section. There are five to nine caudal annuli with no autotomy. The caudal cap is covered with irregular segments.

The lateral sulci are well defined on the posterior two-thirds of the body, but there are no dorsal or ventral sulci. There are numerous diagonal folding lines on the dorsal surface of the body; anteriorly some of them extend below the lateral sulci.

Locality Records. RHODESIA: Wankie: MCZ 67865-67874; UM 1706. Lukosi River Bridge: UM 463-468, 480-485 (Broadley, 1962). Lupane District: NMSR 3366 (Broadley, 1962). Binga: UM 10761-10762, 14703. Sengwa Gorge: UM 12608, 12646, 19713-19717. Chipinda Pools: *UM 31619. Kariba Lake-Sanyati Basin: NMSR 3582 (Broadley, 1962). Kariba Lake-Charara Confluence: CAS 101491, UM 5160-5161, 5169. Lake McIlwaine: (photograph by A. H. Siemers). Buhera: UM 24286. Nyashanu: AMNH 112980-112983; UM 28677-28690, 28692-28710, 28713-28720, 28722-28776 (type series *M. c. rhodesianus*). Mpudzi Bridge: UM 9336-9337, 9654, 10164, 10352, 10415. Whitewaters Bridge: UM 12022. Umvumvumvu Bridge: UM 13387-13388, 16104-16105. Nyanyadzi: UM 18191-18197, 21577-21585, 23074-23085. Birchenough Bridge: UM 2531, 2535, 23787-23803, 23820-23821, 23865-23869, 24285, 25680-25689, 26623-26630 (Broadley, 1962). Tanganda Bridge: UM 28096-28097. Chipangayi Bridge: UM 27409-27413, 27500-27529. Rupisi Hot Springs: UM 27872-27876. Chipinga: UM 28284-28285. Humani Ranch: UM 23935-23962, 29320. Ruware: UM 5831-5832. 65 km. S of Fort Victoria: UM 1159 (Broadley, 1962). Ngundu: UM 2654-2655 (Broadley, 1962), 30222. Lundi Bridge: UM 1160 (Broadley, 1962). Triangle: UM 8484, 29585. Chiredzi: UM 10359, 10607, 17842, 24074, 25503-25504. Rutenga: UM 23872, 23897-23900, 23967, 25553-25566, 25705-25708. Nuanetsi: UM 1161 (Broadley, 1962). Malikango: UM 28813. Chipinda Pools:
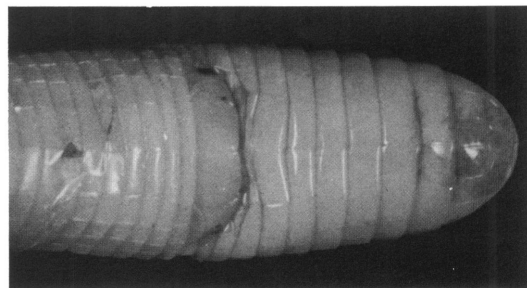

FIG. 59. *Monopeltis c. rhodesianus.* Ventral view of cloaca and tail of UM 25680 from Birchenough Bridge, Rhodesia.

UM 2621-2623 (Broadley, 1962); *UM 31619. Fishan: UM 3839, 19748-19749. Sengwa Gorge: UM 31231.

ZAMBIA: Jeki: UM 4499 (Broadley, 1971a).

MALAWI: Limbe: TM 38223.

MOZAMBIQUE: "Zambezi": BM 1864.6.28.7; (Gray, 1873; Boulenger, 1885; Loveridge, 1941, 1953). "Shire Valley": BM 1864.10.29.17 (Gray, 1873; Boulenger, 1885; Loveridge, 1941, 1953).

Biological Miscellanea. Dermal vertebral ratio = 2.0-2.2 (Alexander and Gans, 1966). Skull (Kritzinger, 1946; Jollie, 1960; Vanzolini, 1951). Vertebral column (Zangerl, 1945; Hoffstetter and Gasc, 1969). Specimen from Bloemfontein, OFS had 12 macro + 22 micro-chromosomes (Huang and Gans, 1971). Burrowing pattern (Gans, 1960). Nasal capsule and Jacobson's organ: (Malan, 1946; Parsons, 1970; Pratt, 1948). Paratympanic organ of Vitali absent (Simonetta, 1960). Visceral anatomy (Merwe, 1940). Ear and hearing (Baird, 1970; Gans and Wever, 1972; Wever and Gans, 1973). Embryos and yolk pattern (Visser, 1967). Rhodesian specimens in stomachs of a quill-snouted snake *Xenocalamus sabiensis* (Broadley, 1971b); also in *X. bicolor lineatus.* Humani Ranch specimen rescued from red-billed hornbill (*Lophoceros erythrorhynchus*).

Monopeltis zambezensis Gans and Broadley
Figures 60-64

Monopeltis zambezensis Gans and Broadley, 1974, p. 3. *Terra typica*: Mana Pools Game Reserve, Urungwe district, Rhodesia. Holotype: UM 5557. Paratypes: CG 2720, UM 5558 (Mana Pools); UM 5041-5044 (Bumi Confluence, Kariba Lake).

Diagnosis. A very small (98 to 170 mm. snout-vent length) species of *Monopeltis* with a diffuse speckling of pigment on the posterior two-thirds of the back and the dorsal surface of the tail more densely pigmented (in adults). The species has from 226 to 263 body, three to five lateral, and six to eight (generally eight) caudal annuli (up to the bluntly rounded tip), 17 to 20 (generally 18 or 20) dorsal, plus 13 to 20 (generally 16), ventral segments to a midbody annulus, and two to four first and five to eight second

postgenial segments. The azygous head shield is single, shows short lateral blind sutures in juveniles and has a slight lateral indentation for the ocular. There are no preoculars. The nasals are short and do not contact the oculars, the lip, or each other. There are four parietals. The pectoral zone is rectangular and the sutures between the six shields roughly parallel. The lateral pair corresponds to fewer dorsal annuli than do the medial pairs. The ventral segments of the prepectoral annulus are enlarged, but not involved in the pectoral shields. The lateral sulci are clearly expressed, but neither dorsal nor ventral sulci are obvious. There are diagonal folding lines on the dorsum. There are two to five fewer dorsal than ventral half-annuli in the second 50 body annuli. The dorsal interannular sutures cross the trunk at right angles to its long axis. Two precloacal pores lie on small segments lateral to the precloacal shields. No autotomy occurs.

Description. This is a small species of *Monopeltis* with the available specimens ranging from 98 to 170 mm. in snout-vent length (fig. 20). The anterior third of the body is unpigmented; the remainder of the body has a speckling of pigment on the dorsum most clearly emphasized along the interannular sutures and laterally to a level ventral to the lateral sulci. The pigmentation becomes denser posteriorly and the distal cap of the tail is solidly pigmented both dorsally and ventrally (only feebly so in smaller specimens).

The single azygous head shield is laterally notched and has short blind lateral sutures in smaller specimens. The dorsal surface of the head shield is slightly convex in profile.

In juveniles the eye is visible as a dark spot beneath the elongate ocular, which is in contact anteriorly with the second supralabial and posteriorly with the parietals. There are four parietal shields, the medial pair being by far the largest; the outer parietals may be separated from the third supralabials by small triangular postocular scales.

The nostrils are crescent-shaped and are inserted in relatively short nasals, that are separated from the ocular, the lip and each other. There are three supralabials, the third the largest.

The lower jaw is formed by a squarish mental, first, second, and enormous third infralabials and
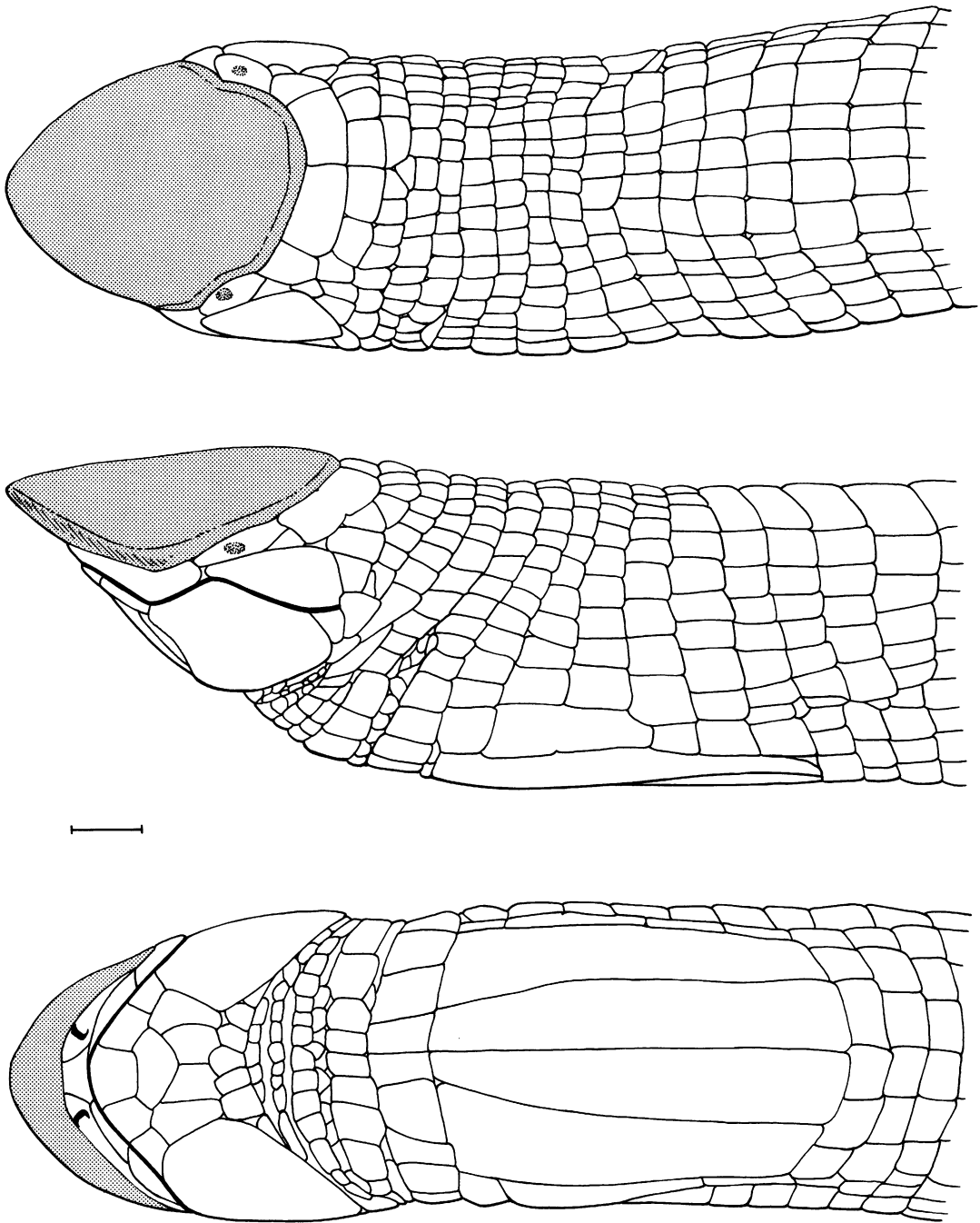
FIG. 60. *Monopeltis zambezensis.* Pattern of head scalation. Dorsal, lateral, and ventral views of head and pectoral region of the holotype UM 5557 from Mana Pools Game Reserve, Urungwe District, Rhodesia. The line equals 1 mm. to scale.
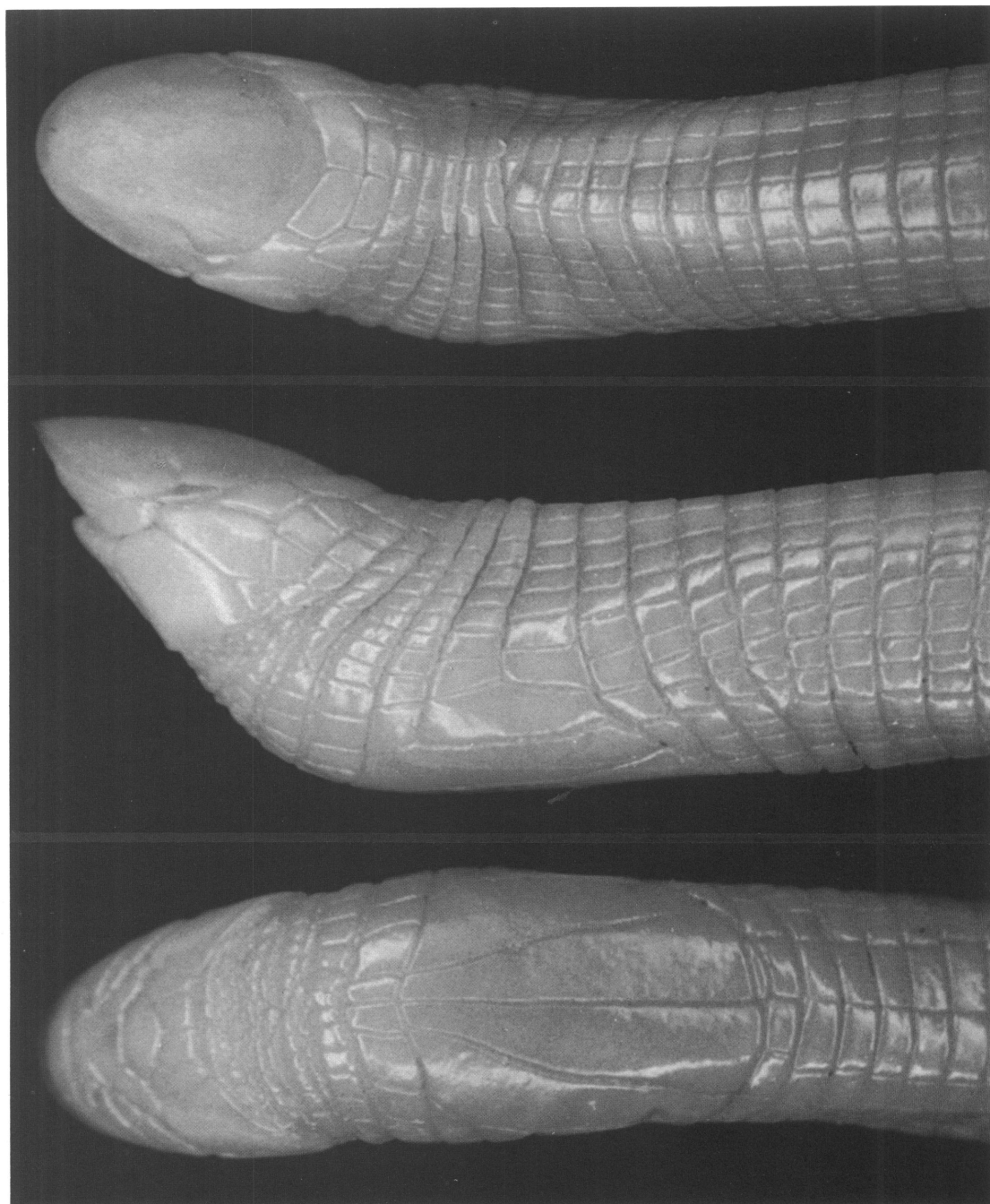
FIG. 61. *Monopeltis zambezensis*. Dorsal, lateral, and ventral views of head of paratype UM 5041 from Kariba Lake, Bumi Confluence, Rhodesia. The highlights on the dorsal surface indicate the position of the nuchal tendons tensed when the head is lifted.
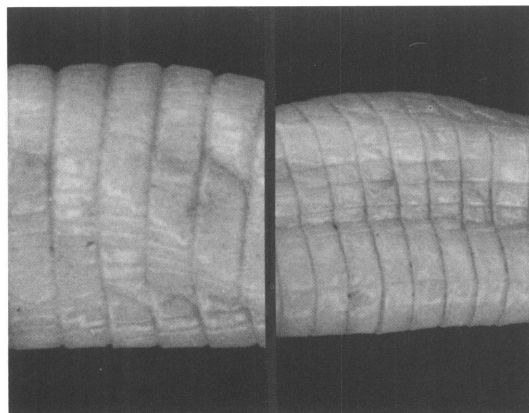
FIG. 62. *Monopeltis zambezensis*. Left, dorsal view, and right, ventral view at midbody to show segment arrangement of paratype UM 5041 from Kariba Lake, Bumi Confluence, Rhodesia.

a wide shield-shaped postmental (genial). Posterior to the postmental are four (rarely two or three) first postgenials and five to eight small second postgenials.

The modified pectoral region extends to the eighth through the tenth dorsal annulus; there are six elongate parietals, the medial pair narrowed anteriorly, the lateral pair tending to break up into the four to six constituent segments.

There are 226 to 263 body annuli from the posterior edge of the third infralabial up to, but not including, the precloacal shields. There are up to seven fewer dorsal than ventral half-annuli; most of these being lost in the second 50 body annuli.

A midbody annulus has 17 to 21 dorsal plus 15 to 18 ventral segments. The middorsal segments are approximately twice as long as wide and the midventral segments two to five times as wide as long. The number of dorsal segments is slightly greater than the number of ventral segments for any given specimen.

There are three to five lateral annuli. The first one contacts the two enlarged medial precloacal shields and its terminal segments bear a pair of precloacal pores.

The short tail is smoothly rounded and appears subcylindrical in cross section. There are

six to eight (usually eight) caudal annuli with no autotomy. The caudal cap is divided into irregular segments.

The lateral sulci are well defined on the posterior three-quarters of the body, but there are no dorsal or ventral sulci. There are many diagonal folding lines on the dorsal surface of the body.

Locality Records. RHODESIA: Kariba Lake, Ukubula Island, Bumi Confluence: UM 5041-5044 (Paratypes of *M. zambezensis*). Urungwe Reserve, Mana Pools: CG 2720 (Paratype): UM 5557 (Holotype), UM 5558 (Paratype of *M. zambezensis*).

Monopeltis sphenorhynchus sphenorhynchus
W. C. H. Peters
Figures 30-32, 65-69

Lepidosternon sphenorhynchum Gray, 1865, p. 454. Peters's MS name cited without description; hence a *nomen nudum*.

Monopeltis sphenorhynchus W. C. H. Peters, 1879, p. 275. *Terra typica*: "Mocambique und Angola"; restricted to "Inhambane, Mozambique" (Loveridge, 1941, p. 427). Lectotype: ZMU 1400 by present designation. Paralectotype: ZMU 9423.

Monopeltis habenichti FitzSimons, 1937b, p. 276. *Terra typica*: "Lourenco Marques, Portuguese East Africa" (Mozambique). Holotype: TM 3400. Paratypes: TM 3401, 3402.

Monopeltis capensis gazei FitzSimons, 1937b, p. 278. *Terra typica*: "Junction of the Magalakwin and Limpopo rivers, Zoutpansberg District, Northern Transvaal." Holotype: TM 13342. Paratype: TM 3477 (Nwanedzi River, Zoutpansberg District).

FIG. 63. *Monopeltis zambezensis*. Ventral view of cloaca and tail of paratype UM 5041 from Kariba Lake, Bumi Confluence, Rhodesia.
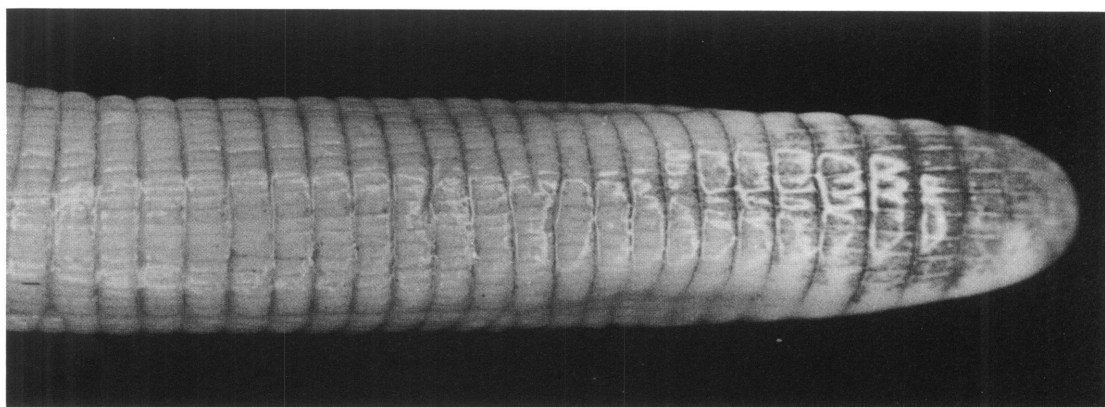
FIG. 64. *Monopeltis zambezensis.* View of dorsal surface of tail of holotype UM 5557 from Mana Pools Game Reserve, Urungwe District, Rhodesia, to show shape and pigmentation.

Diagnosis. A small to medium-sized (207 to 326 mm. snout-vent length in adults) slender form of *Monopeltis* with the dorsal surface immaculate or marked by only a diffuse scattering of melanophores. Specimens have 228 to 284 body (see geographic variation), three to six lateral and seven to 11 (generally nine) caudal annuli (up to the smoothly rounded tip that may show faint lateral compression), 22 to 37 dorsal (see geographical variation) plus 14 to 26 (generally 16, 18, or 20) ventral segments to a midbody annulus and two (rarely three) large segments to the first plus three to seven (generally five) to the second postgenial row. The azygous head shields are discrete in juveniles, but almost completely fused in specimens larger than 130 mm. The strongly keratinized shield of larger specimens lacks any trace of an ocular notch. The nasals do not contact each other or the ocular, from which they are separated by broad contact between the azygous head shield and the second supralabial. They often contact the lip, either anterior to a reduced first supralabial, or by fusion with this (leading to two supralabials). There are six parietal shields. The pectoral region is long and slender. The medial pair of the six slender shields (which correspond dorsally to five body annuli) is longest and extends farthest anteriorly, so that the narrowed last prepectoral annulus makes a short radius curve around the anterior end of the

shield. The lateral sulci are poorly expressed and dorsal and ventral ones are absent. There are diagonal folding lines on the dorsum. Many specimens have no supernumerary dorsal half-annuli; there are never more than three and some specimens show a reduction of up to nine half-annuli. The dorsal interannular sutures cross the trunk at right angles to its long axis. Two large precloacal pores lie on the terminal segments of the first lateral annulus, which are in contact with the large median pair of precloacal shields. No autotomy occurs.

Description. This is a medium-sized form of *Monopeltis* with the available specimens from 104 to 326 mm. in snout-vent length (fig. 20). The dorsum is marked by a diffuse sprinkling of melanophores, except for the nuchal region and tail, which is immaculate.

The dorsal surface of the head is divided into two discrete azygous head shields in small juveniles. These segments are almost completely fused in specimens that exceed 130 mm. in snout-vent length. In large specimens the strongly keratinized shield lacks any trace of a lateral suture. The head shield is slightly convex in profile.

In juveniles the eye can just be distinguished as a dark spot beneath the lozenge-shaped ocular, which makes contact with the second supralabial. A row of six parietals separates the large head shield from the first body annulus.
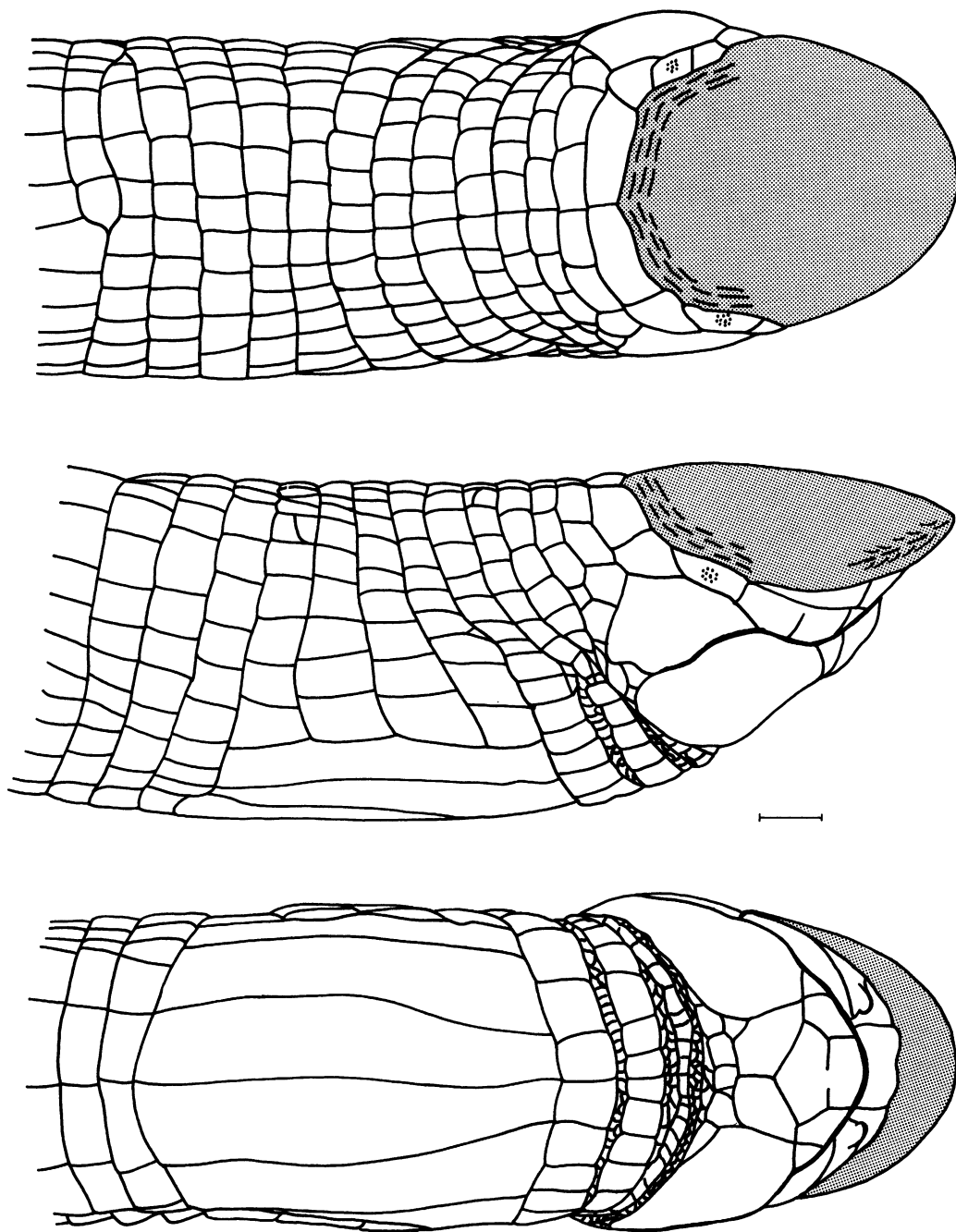
FIG. 65. *Monopeltis sphenorhynchus sphenorhynchus.* Pattern of head scalation. Dorsal, lateral, and ventral views of head and pectoral region of NKW 133 from Madzaringue Firebreak, Kruger National Park, South Africa. The line equals 1 mm. to scale.

FIG. 66. *Monopeltis sphenorhynchus sphenorhynchus*. Dorsal, lateral, and ventral views of head and pectoral zone of NKW 133 from Madzaringue Firebreak, Kruger National Park, South Africa.

The nostrils are crescent-shaped and inserted into relatively short nasal scales which often border the lip, but are well separated from the ocular and each other. There are usually three supralabials, but the first may be fused with the nasal.

The lower jaw is formed by an almost rectangular mental, first, second (often fused with first), and enormous third infralabials, and a rather small heart-shaped postmental (genial). Posterior to the postmental are a pair (rarely three) of
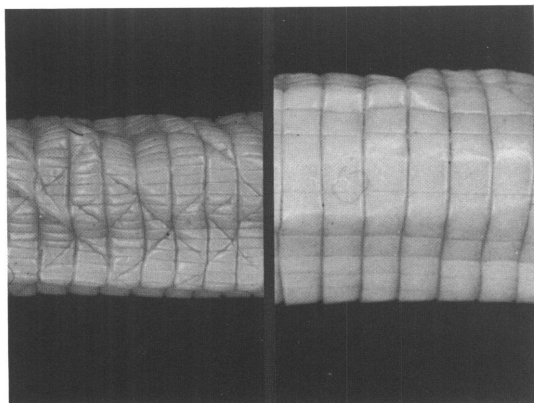
FIG. 67. *Monopeltis s. sphenorhynchus*. Left, dorsal view, and right, ventral view at midbody to show segment arrangement of NKW 133 from Madzaringue Firebreak, Kruger National Park, South Africa.

large first postgenials in broad medial contact followed by three to seven (usually five) very small second postgenials.

The modified pectoral region extends from the eighth to eleventh dorsal annulus. There are six elongate segments, the medial pair widest posteriorly and projecting anteriorly so that the narrowed prepectoral annulus curves around them. The lateral pair tend to be broken up.

There are 228 to 284 body annuli from the posterior edge of the third infralabial up to (but not including) the precloacal shields. Supernumerary dorsal half-annuli do not exceed three and in nearly 50 percent of the specimens there is actually a reduction in the number of dorsal half-annuli, reaching a maximum of nine in USNM 58741. A midbody annulus has 22 to 37 dorsal plus 16 to 26 ventral segments. The middorsal segments are approximately four times longer than wide and the midventral segments are approximately one and a-half times to twice as wide as long. The number of dorsal segments is always much greater than the number of ventral segments for any given specimen.

There are three to six lateral half-annuli; the enlarged outer segments of the first half-annulus each bear a precloacal pore and are in contact with the very large medial pair of precloacal

shields and also a pair of very small lateral precloacal shields.

The very short tail is smoothly rounded and appears subcylindrical in cross section. There are seven to 11 caudal annuli with no autotomy. The segments of the caudal cap tend to be fused.

The lateral sulci are very feebly defined and there are no dorsal or ventral sulci. There are numerous diagonal folding lines on the dorsal surface of the body.

Locality Records: SOUTH AFRICA: *Transvaal*: Magalakwin-Limpopo Confluence: TM
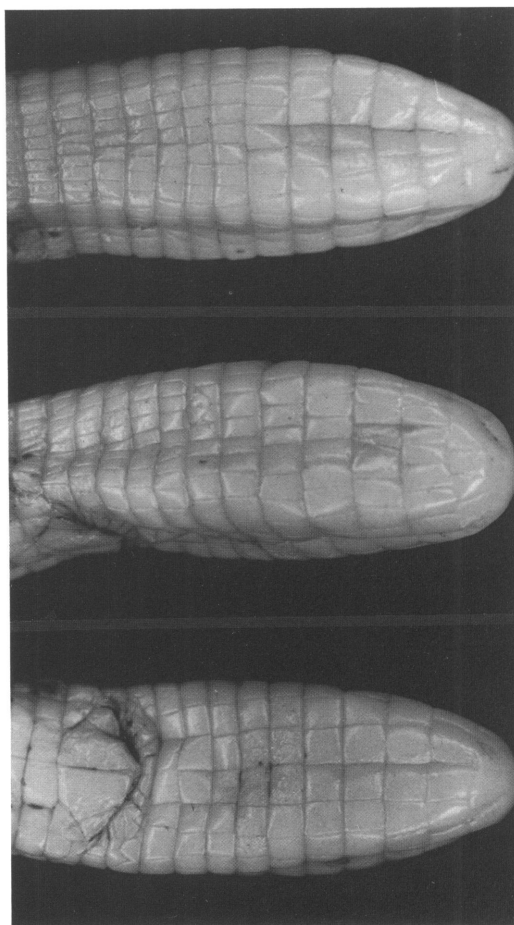

FIG. 68. *Monopeltis s. sphenorhynchus*. Dorsal, lateral, and ventral views of cloaca and tail of NKW 133 from Madzaringue Firebreak, Kruger National Park, South Africa.
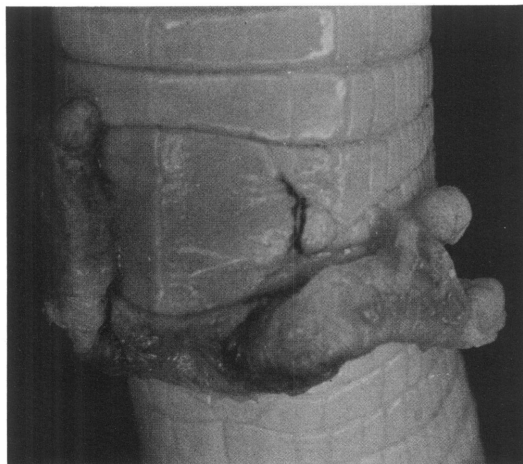
FIG. 69. *Monopeltis s. sphenorhynchus.* Latero-ventral view of cloaca of UM 28501 from Mapinhane, Mozambique, to show everted left hemipenis with T-shaped head.

13342 (Holotype *M. capensis gazei* FitzSimons, 1937b; 1943). Philipstown Farm: TM 42332. Waterpoort: CG 4857; JV 9054-9058. Nwanedzi-Limpopo Confluence: TM 3477 (Paratype *M. capensis gazei* FitzSimons, 1937b; 1943). Kruger National Park-Madzaringue Firebreak: NKW 133 (Pienaar, 1966). Western boundary, north of Mutale River: *NKW/NP 46 A-C, 51 A-K; between Luvuvhu and Mutale rivers *NKW/NP 55 A-K. Eastern Boundary-Malonga Fountain: *NKW (21 specimens), *UM 31603-31605. Malonga Fountain to Nyandu Sandveld: *NKW (28 specimens), **UM 31593-31595. Nyandu Sandveld: *NKW (13 specimens); *UM 31591-31592. Nyandu Sandveld to Masambela: *NKW (three specimens). *Natal*: Sordwana Bay Park: *TM 45553.

MOZAMBIQUE: Maphinhane: UM 28501. Inhambane: RMNH 3564; ZMU 1400 (Lectotype *M. sphenorhynchus* Peters, 1879), ZMU 9423 (Paralectotype *M. sphenorhynchus* Peters, 1879. Bocage, 1896, in error, refers to Humbe, Angola. Peters, 1854, 1855, 1882 with illustrations: Strauch, 1881). (Does Lichtenstein, 1856, refer to this?) Chimonzo: TM 29835. Manhica: CZL 532-539, 664 (Manaças, 1957). Lourenço Marques: TM 3400 (Holotype). TM 3401-3402

(Paratypes), 3323 ("Topotype" of *M. habenichti* FitzSimons, 1937b, 1943), TM 28716. Chikirimbane (not traced): NMB 7397.

? TANZANIA: Sicumba (not traced): USNM 58741.

No Locality. ZMU 39404.

Biological Miscellanea. Skull (Peters, 1882). Shoulder girdle (Fürbringer, 1900). The everted hemipenes of UM 28501 are illustrated (fig. 69).

Monopeltis sphenorhynchus mauricei Parker,
new combination
Figures 30-32, 70-73

Monopeltis mauricei Parker, 1935, p. 582. *Terra typica*: "Monjalatsela, near Ghanzi, Bechuanaland" (Botswana). Holotype: BM 1933.9.9.-14:-RR1946.8.2.37.

Monopeltis ocularis FitzSimons, 1941, p. 277. *Terra typica*: "Swart Modder, Rietfontein," Cape Province. Holotype: McGregor Museum, Kimberley, Cape Province (unnumbered).

Diagnosis. A small to medium-sized (220 to 365 mm. snout-vent length in adults) slender form of *Monopeltis* with the dorsal surface immaculate or marked by only a diffuse speckling of melanophores. Specimens have 276 to 316 body, four to seven lateral and eight to 12 (generally nine or 10) caudal annuli (up to the smoothly rounded caudal tip, that may be slightly compressed laterally), 30 to 42 dorsal plus 16 to 29 (generally 20, 22, or 24) ventral segments to a midbody annulus and two (very rarely three or four) large first, plus three to seven (generally five) segments to the second postgenial row. The azygous head shields are discrete in some juveniles, whereas others retain short blind lateral sutures. Larger specimens lack even lateral notches for the oculars in the strongly keratinized head shield. The nasals do not contact each other or the lip; their elongate posterior processes (sometimes broken off to form postnasals) always contact the quadrangular ocular. There are four to six parietals. The pectoral region is long and slender. The medial pair of the six slender shields (which correspond dorsally to four or five body annuli) is the longest and extends anteriorly so that the narrowed last prepectoral annulus makes a short radius curve
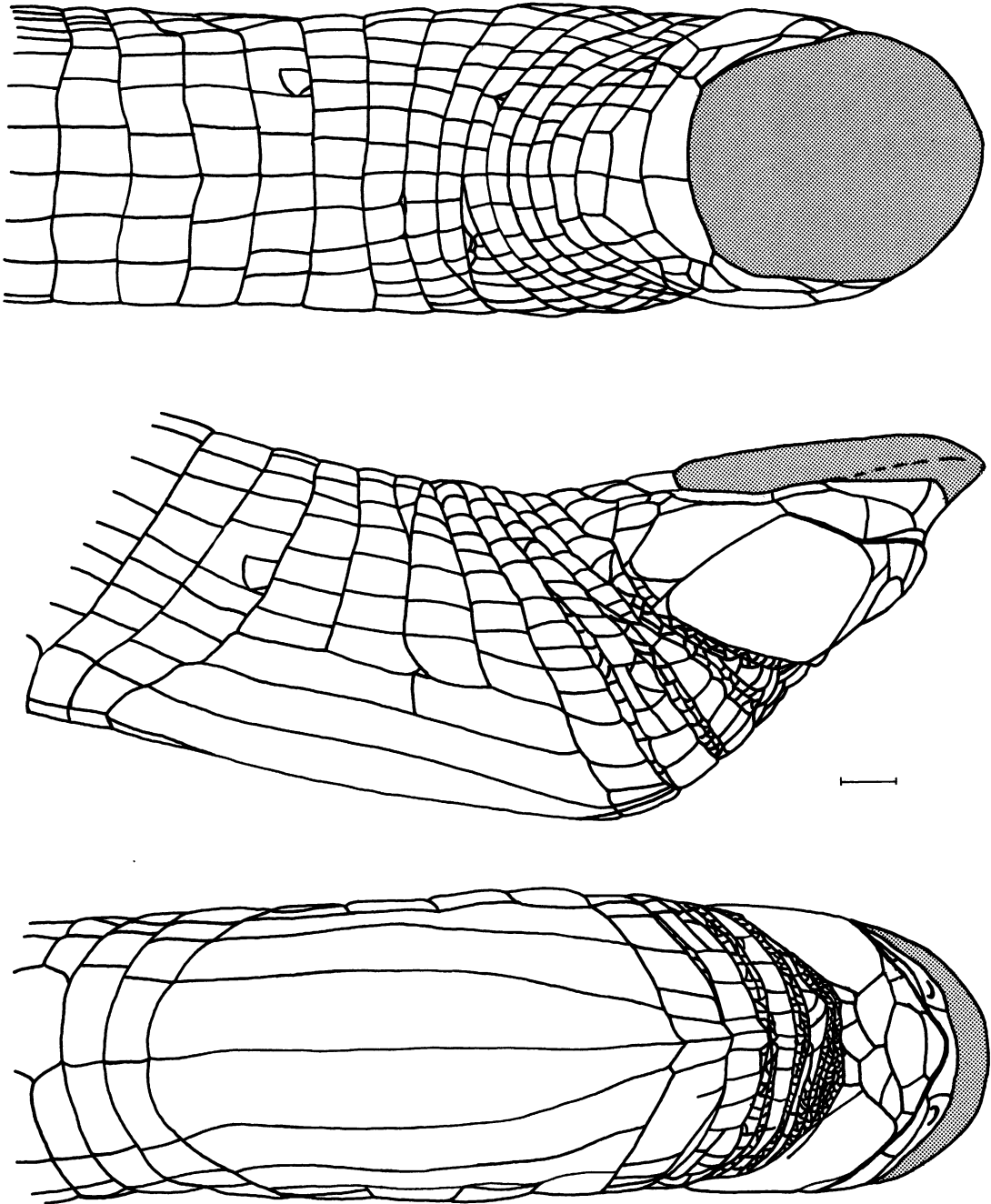
FIG. 70. *Monopeltis sphenorhynchus mauricei.* Pattern of head scalation. Dorsal, lateral, and ventral views of head and pectoral region of UM 24249 from Katima Mulilo, South West Africa. The line equals 1 mm. to scale.
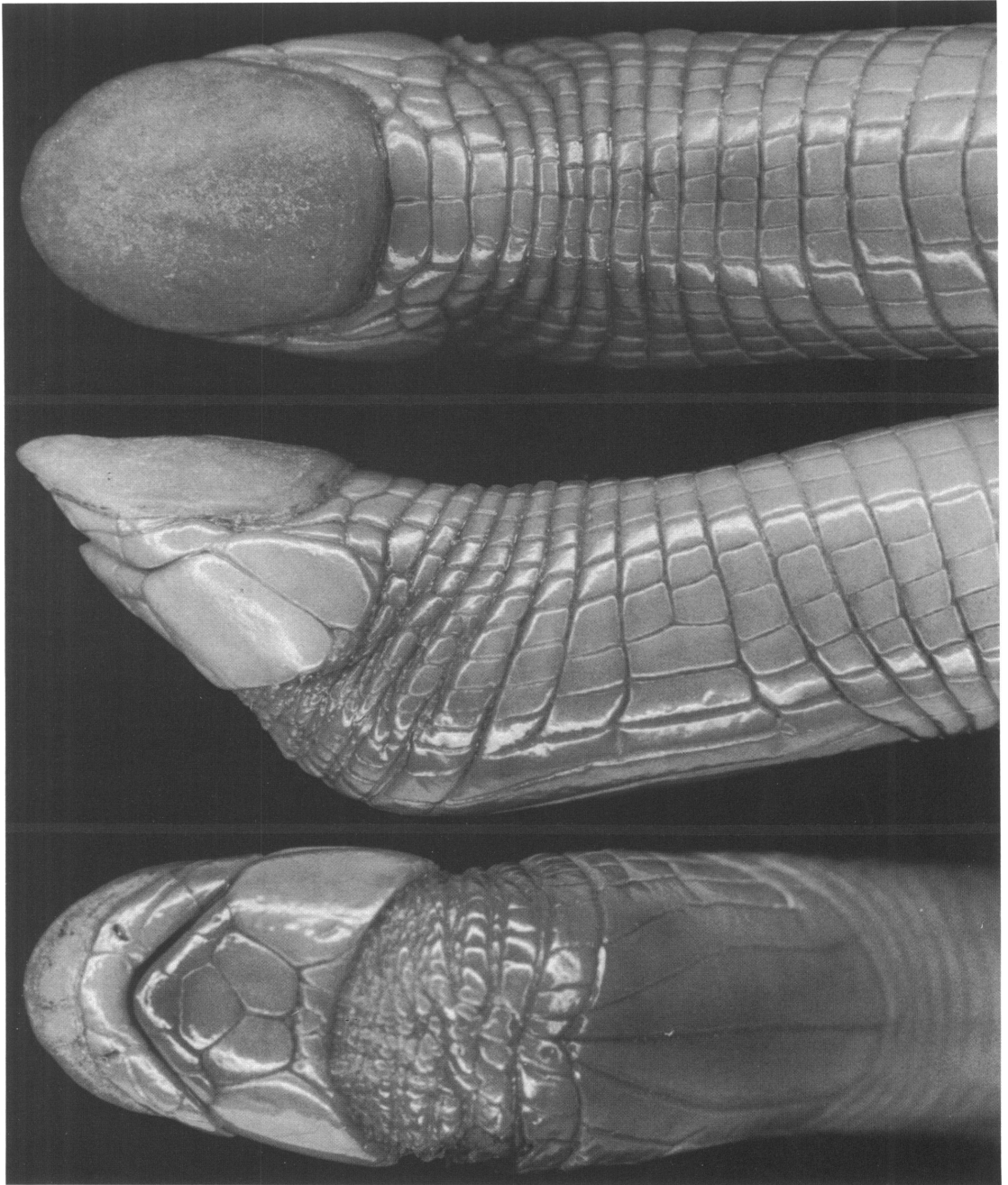
FIG. 71. *Monopeltis sphenorhynchus mauricei.* Dorsal, lateral, and ventral views of UM 23032 from 15 km. WSW of Katima Mulilo, Caprivi Strip, South West Africa.

round it. The lateral sulci are often poorly expressed and dorsal and ventral ones are absent.

There are diagonal folding lines on the dorsum. Many specimens have no supernumerary dorsal
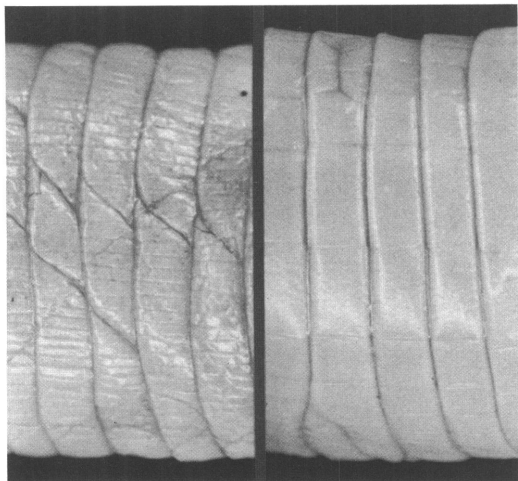
FIG. 72. *Monopeltis sphenorhynchus maur-icei.* Left, dorsal view, and right, ventral view of midbody to show segment arrangement and pigmentation of UM 23032 from 15 km. WSW of Katima Mulilo, Caprivi Strip, South West Africa.

half-annuli; the maximum number is 16, but there may be a reduction of up to seven half-annuli. The dorsal interannular sutures cross the trunk at right angles to its long axis. Two large precloacal pores lie on the terminal segments of the first lateral annulus, which are in contact with the large median pair of precloacal shields. No autotomy occurs.

Description. This is a medium-sized form of *Monopeltis* with the available specimens ranging from 105 to 365 mm. snout-vent length (fig. 20). The dorsal surface may have a diffuse sprinkling of melanophores, but is more often immaculate.

The dorsal surface of the head is divided into two discrete azygous shields in some juveniles, whereas others retain short blind lateral sutures. Larger specimens have strongly keratinized head shields with no lateral sutures or indentations for the oculars. The head shield may be distinctly convex in profile, but is more often slightly convex posteriorly and concave anteriorly.

In juveniles the eye can be distinguished deep beneath the anterior end of an elongate, curved striplike ocular, which is in contact anteriorly with both a small postnasal (sometimes fused with the nasal) and the second supralabial, whereas posteriorly it contacts the medial pair of

four to six parietals. A triangular subocular shield is wedged between it and the third supralabial.

The nostrils are crescent-shaped and inserted in elongate nasal scales that are in contact (or fused) with the postnasals, but separated from the lip and each other. There are three supralabials.

The lower jaw is formed by a pentagonal mental, first, second (very small), and enormous third infralabials and a shield shaped postmental (genial). Posterior to the postmental are one (rarely two) pair(s) of large first postgenials in broad median contact, followed by three to seven (generally five) small second postgenials.

The modified pectoral region extends to the eighth to eleventh dorsal annulus. There are six elongate segments; those of the medial pair are widest posteriorly and taper anteriorly, where they project into the prepectoral annulus, the midventral segments of which make a short radius curve around them.

There are 276 to 316 body annuli from the posterior edge of the third infralabial up to (but not including) the precloacal shields. Supernumerary dorsal half-annuli are generally few, but reach a maximum of 16 in TM 42411, whereas other specimens show a reduction in dorsal half-annuli of up to seven. A midbody annulus has 30 to 42 dorsal plus 16 to 29 ventral segments. The middorsal segments are approximately five times as long as wide and midventral segments are approximately one and a-half times as wide as long. The number of dorsal segments is always much greater (nearly twice) than the number of ventral segments for any given specimen.

There are four to seven lateral half-annuli, the enlarged outer or penultimate segments of the first half-annulus each bear a precloacal pore and are usually in contact with both pairs of precloacal shields (rarely fused with the outer pair).

The very short tail is smoothly rounded and appears subcylindrical in cross section although often showing dorsal and ventral grooves. There are seven to 10 caudal annuli with no autotomy. The segments of the caudal cap tend to be fused.

The lateral sulci are ill defined and there are no dorsal or ventral sulci. There are diagonal folding lines on the dorsal surface of the body.

Locality Records: SOUTH WEST AFRICA: Western Okavango: SMF 49646 (Mertens, 1971). Etosha Pan Game Reserve (bordering Onguma

Farm): TM 40059. "Damaraland": NRM 1666. Labora Farm: TM 33228. 65 km. WSW of Katima Mulilo: UM 21536-45. 15 km. WSW of Katima Mulilo: AMNH 112968-112971; UM 21365-21377, 23030-23035, 23038, 23039, 23041, 23043-23048. Katima Mulilo: UM 24249-24251.

SOUTH AFRICA: *Cape Province*. Kalahari Gemsbok National Park-western boundary: *NKW (2 specimens). Swart Modder, Rietfontein: MMK (unnumbered) (Holotype of *M. ocularis* FitzSimons, 1941, 1943). Gordonia District: MMK (unnumbered). Noenieput: JV 2016, 3017.

BOTSWANA: Khwai: UM 28211-28212. 15 km. S of Maxwee: UM 25430-25432. Shorobe: UM 20772, 20808. Maun: UM 18096, 20761, 20811. Kaumaha: UM 16129. Monjalatsela, near Ghanzi: BM 1933.9.9.14. (RR 1946.8.2.34) (Holotype *M. mauricei* Parker, 1935; Loveridge, 1941; FitzSimons, 1943). 40 km. S of Tshane: UM 22161-22162. 55 km. S of Tshane: UM 22353-22356. Mabua Sehubi Pan: UM 13051-13052. Khutse Game Reserve: TM 42411. Takatokwani Pan: USNM 160743. Dikomu-di-Kai: NMSR 1154 (Broadley, 1962).

RHODESIA: Victoria Falls UM 23194-23195, 23219-23222. Wankie National Park-Dandari Pan: UM 28332. Main Camp: UM 23673. Dopi Pan: UM 20323-20327, 29582. 20 km. W of Gosivanini Pan: *UM 31506. Ngamo: UM 23674. Dett Airport: UM 23258.

ZAMBIA: Sesheke: NMSR 3498 (Broadley, 1962, 1971a). Kafue National Park-Ngoma: UM 17876, 20854-20855, 23386, 23398 (Broadley,

1971a); Shakalonga (Siakalongo): NMSR 4288 (Broadley, 1962, 1971a).

Biological Miscellanea. Katima Mulilo specimens in stomach of a quill-snouted snake *Xenocalamus mechowii* (Broadley, 1971b).

Monopeltis kabindae Witte and Laurent
Figures 74-77

Monopeltis kabindae Witte and Laurent, 1942, p. 76. *Terra typica*: "Kabinda" (Kasai), Zaire. Holotype: RGMC 6773.

Diagnosis. A small (188 mm. snout-vent length) slender form of *Monopeltis* lacking pigmentation. The holotype has 223 body and nine caudal annuli (up to the laterally compressed caudal tip), 18 to 20 dorsal and 13 to 14 ventral segments to a midbody annulus, and two (separated) first and six second postgenial segments. The azygous head shield is single and smoothly rounded. The species lacks ocular notches and preocular segments. (The eye pigment has faded so that the position of the ocular is uncertain.) The nasals do not contact each other, the lip, or the oculars. The pectoral region is elongate and covered by three pairs of roughly parallel shields, of which the medial ones are the longest. The lateral sulci are clearly expressed and there is no dorsal sulcus, but irregular dorsal folding lines. Only the second 50 body annuli have supernumerary dorsal half-annuli. Interannular sutures cross the trunk at right angles. There are no precloacal pores (in the juvenile specimen) and the species lacks autotomy.

Description. This is a small-sized species of *Monopeltis* with the unique specimen measuring 188 mm. in snout-vent length (fig. 20). The specimen lacks all traces of dark pigmentation.

The dorsal surface of the head is slightly convex in profile and covered with a single azygous head shield, keratinized over its entire surface, and lacking even a trace of blind lateral sutures.

No eye is visible beneath the very elongate rectangular ocular, which reaches from the second and third supralabials to contact the medial pair of the four parietals that span along the posterior extent of the azygous head shield, from the dorsal edges of the third supralabials anterior to the first body annulus.

The nostrils are crescent-shaped and inserted into fairly long nasal scales, which are well sepa-
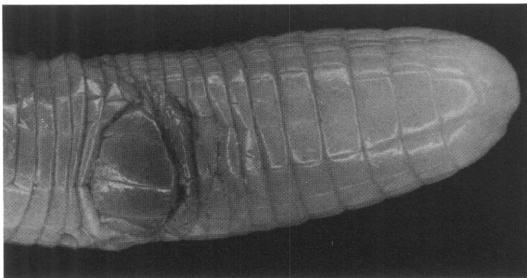

FIG. 73. *Monopeltis sphenorhynchus mauricei*. Ventral view of cloaca and tail of UM 23032 from 15 km. WSW of Katima Mulilo, Caprivi Strip, South West Africa.
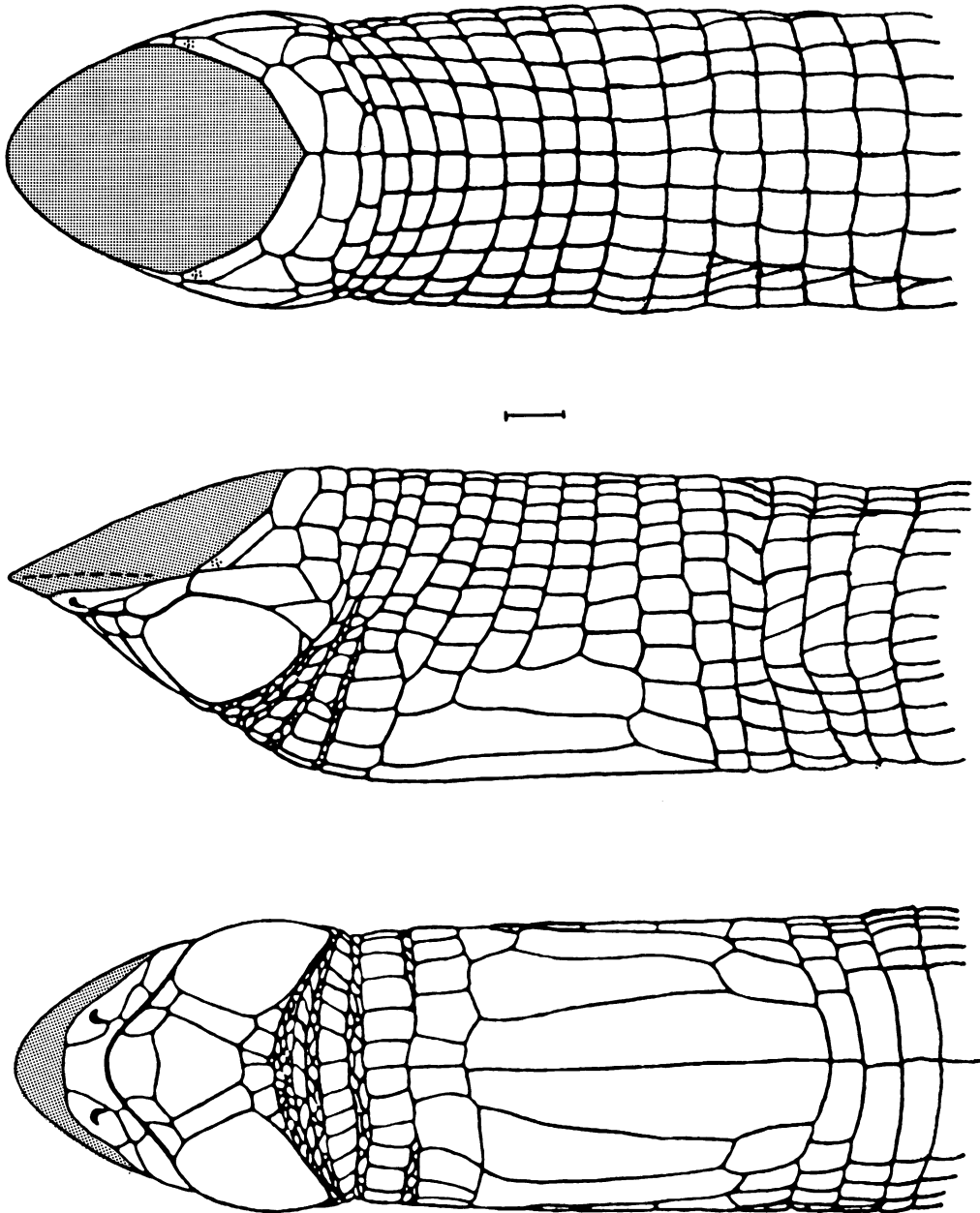
FIG. 74. *Monopeltis kabindae.* Pattern of head scalation. Dorsal, lateral, ventral views of head and pectoral region of the holotype RGMC 6773 from Kabinda, Kasai, Zaire. The line equals 1 mm. to scale.

rated from the ocular, the lip, and each other. There are three supralabials, the third by far the largest. A triangular last and fourth supralabial extends beyond the gape.

The lower jaw is covered by a rectangular mental, the first, second, and enormous third infralabials, and the enlarged heart-shaped postmental (genial). The postmental makes a bow-
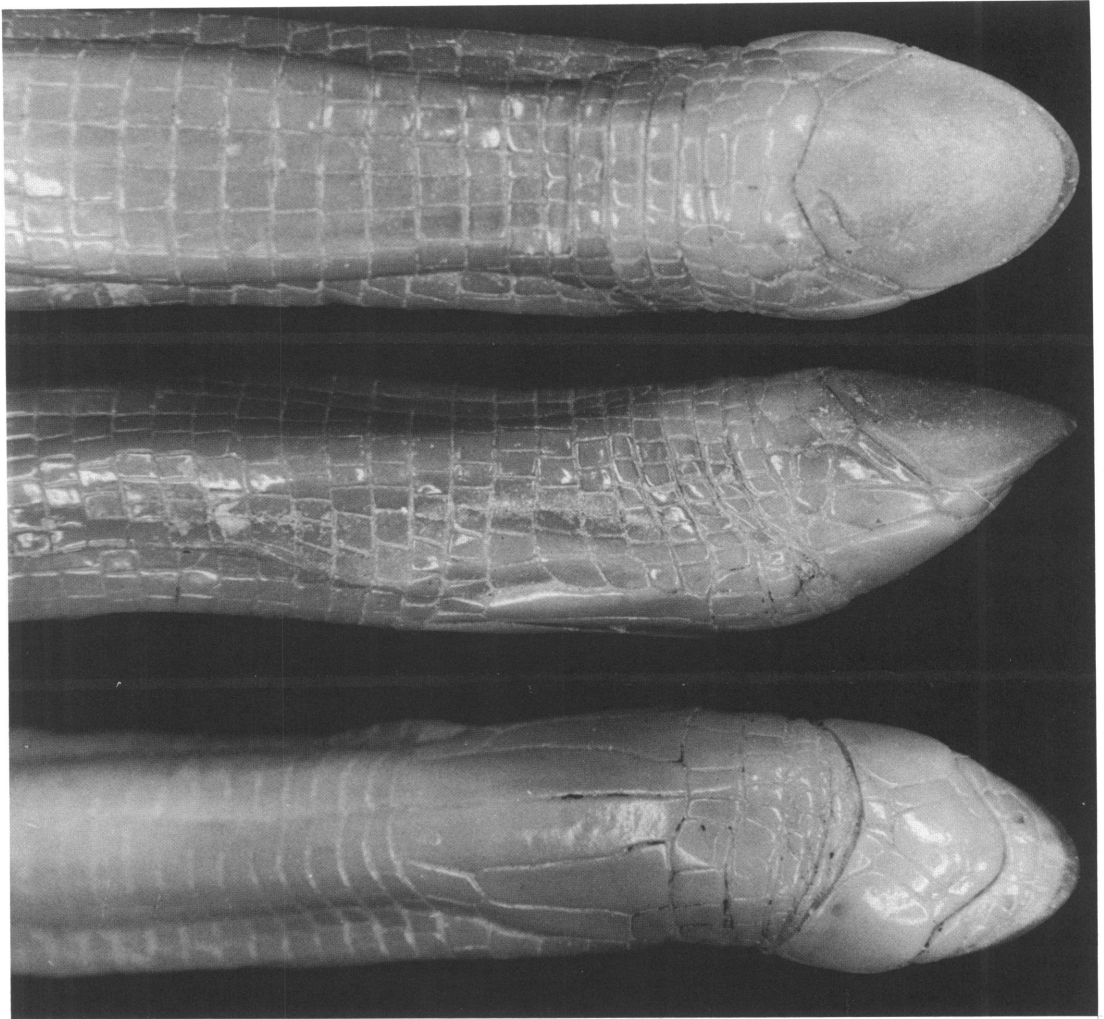
FIG. 75. *Monopeltis kabindae*. Dorsal, lateral, and ventral views of head of holotype RGMC 6773 from Kabinda, Kasai, Zaire.

shaped anterior contact with the mental, and contacts the first infralabials, but is separated from contact with the second by their contact with the elongate first postgenials, that flank it but do not contact each other on the midline. Six postgenials represent the second row, posterior to which the cover of the jaw is limited by the deep gular fold.

The modified pectoral region extends from the third or fourth to the eleventh dorsal annulus; there are six roughly parallel elongate and subrectangular pectorals, the median pair the longest and slightly narrowed anteriorly. The lateral pairs reach only to the tenth body annulus. The midventral segments of the prepectoral annulus are slightly enlarged, but are not involved with the pectoral shield.

There are 223 body annuli from the posterior edge of the fourth infralabial up to (but not including) the precloacal shield. Two supernumerary dorsal half-annuli occur in the second 50 body annuli. A midbody annulus has 18 to 20
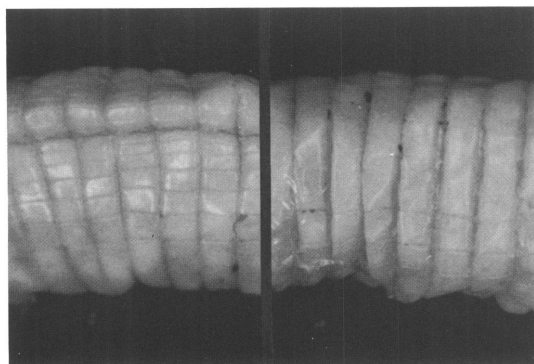
FIG. 76. *Monopeltis kabindae.* Left, lateral view, and right, ventral view at midbody to show segment arrangement and pigmentation of the holotype RGMC 6773 from Kabinda, Kasai, Zaire.

dorsal, plus 13 to 14 ventral segments. The mid-dorsal segments are approximately three times as long as wide and the midventral segments two and one-half times as wide as long. The number of dorsal segments is greater than the number of ventral segments. There are five lateral annuli, the first one or two in lateral contact with the widened precloacal shield. There are no precloacal pores.

The tail is dorsally heightened and shows some lateral compression. It appears vertically oval in cross section. There are nine caudal annuli, with no autotomy. The caudal cap is sub-divided into somewhat irregular slightly enlarged segments and the raphes between the last caudal annuli are much shallower than those between the more anterior ones.

The lateral sulci are strongly marked and there is no dorsal sulcus. Numerous irregular diagonal folding lines cross the dorsum.

Locality Records. ZAIRE: Kabinda, Kasai: RGMC 6773 (Holotype *Monopeltis kabindae* Witte and Laurent, 1942; Witte, 1954).

Monopeltis perplexus Gans
Figures 78-81

Monopeltis perplexus Gans 1976, p. 6. *Terra typica*: "Hanha or Capelongo, Angola." Holo-type: AMNH 47732. Paratypes: AMNH 47731, 47733-47735.

Diagnosis. A small (215 to 300 mm. snout-vent length in adults), slender species of *Monopeltis* with the dorsal surface darkened by a speckling of individual melanophores evenly spaced across the segments (mainly after the first third of the body and to just ventral of the lateral sulci, but onto the ventral surface of the tail). The speckles fuse into a darker tone on the anterior part of the dorsal surface of the tail. The species has 261 to 270 body and 22 to 24 caudal annuli (up to the smoothly and parabolically rounded tip), 12 to 17 (generally 16) dorsal and 14 to 16 ventral segments to a midbody annulus, and four postgenial plus five postmalar segments. The azygous head shields are broadly fused and only a short blind suture remains anterior to the ocular at the base of a notch in the heavy keratinous shield. There are no preoculars. The slender posterior processes of the nasals (which segments do not contact each other medially, but may touch the lip) are excluded from touching the ocular by a wide contact zone of the third supralabial and the head shield. The pectoral region is relatively short and wide. It is formed of six main shields, partial fusion occurring azygously between the lateral pairs, and the almost triangular medial pair being by far the largest. Sutures radiate from the front and a pair of enlarged segments of the prepectoral annulus inserts lateral to the medial pair. Lateral and mid-dorsal sulci are clearly expressed. Fewer than three supernumerary dorsal half-annuli occur, mainly in the first and second 50 body annuli. The dorsal interannular sutures cross the trunk at right angles to its long axis. There are no pre-

FIG. 77. *Monopeltis kabindae.* Ventral view of cloaca and tail of the holotype RGMC 6773 from Kabindae, Kasai, Zaire.
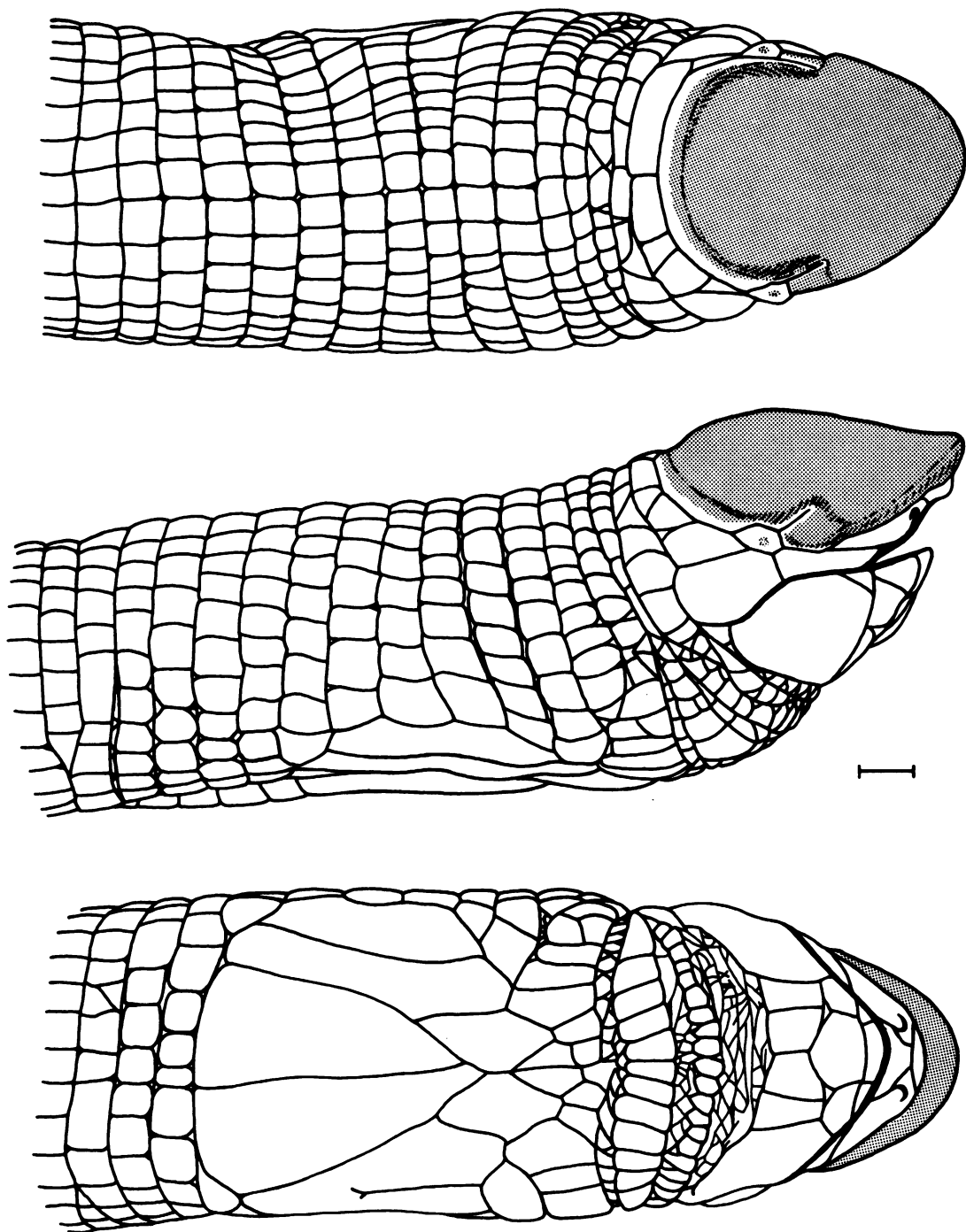
FIG. 78. *Monopeltis perplexus.* Pattern of head scalation. Dorsal, lateral, and ventral views of head and pectoral region of the holotype AMNH 47732 from "Hanha or Capelongo," Angola. The line equals 1 mm. to scale. (After Gans, 1976).

cloacal pores. Autotomy occurs at the fifth to seventh caudal annulus.

Description. This is a small-sized slender species of *Monopeltis* with the available adult specimens ranging from 215 to 300 mm. in snout-vent length (fig. 20). The dorsal surface is darkened by a faint speckling of individual melanophores, evenly spaced across the segments. The dorsal pigmentation begins to be seen posterior to the first third of the body and extends just ventral to the lateral sulci. The ventral surface of the tail, particularly the narrowed autotomy annulus, shows faint pigment emphasis. The speckles fuse into a darker tone on the anterior part of the dorsal surface of the tail, but the caudal tip lacks pigment.

The dorsal surface of the head is covered by a broadly fused azygous head shield with only short blind sutures extending anteromedially from the level of the ocular. The dorsal region of the anterior portion is slightly concave and the posterior portion is convex. The entire zone is heavily keratinized, except for a strip along the
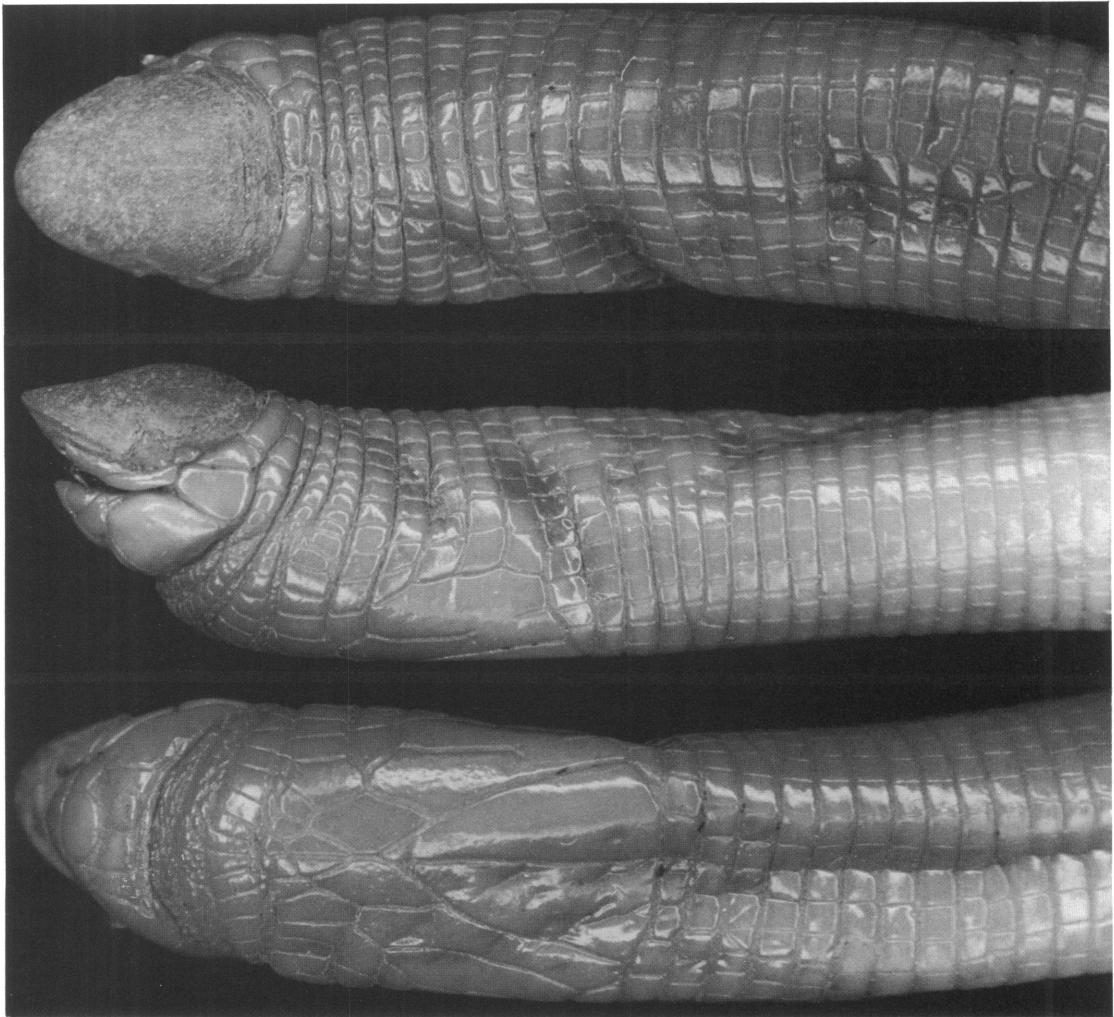

FIG. 79. *Monopeltis perplexus.* Dorsal, lateral, and ventral views of head of holotype AMNH 47732 from "Hanha or Capelongo," Angola.

posterior edge and the concave region immediately anterior to the blind sutures (and the oculars which lie just posterior to these).

The eye is faintly (more so in smaller specimens) visible deep beneath the pentagonal ocular, that has a vertical anterior suture, a horizontal one versus the azygous head shield, and a ventral one versus the second and third supralabials, whereas the pointed posterior tip of the ocular lies adjacent to the lateralmost of the five to eight (usually six) parietals that border the posterior edge of the azygous shield between the third supralabials. The row of parietals separates the shield from the first body annulus.

The crescent-shaped nostrils are inserted in medium-sized nasals which are well separated from the oculars, the lip and each other. There are three supralabials; the third by far the largest.

The lower jaw is covered by a somewhat squarish mental, the first, second, and enormous third infralabials, and the large, shield-shaped postmental (genial) that may or may not have point contact with the first infralabials. Posterolaterally to the postmental lie two pairs of postgenials; the medial pair invariably is in contact posterior to the postmental and sometimes excludes the rectangular lateral pair from contact with the postmental. Rarely are these tiny segments of the gular fold in the position of second postgenial segments. Postmalars are lacking.
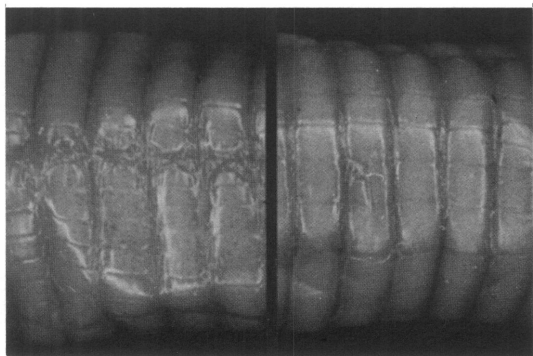

FIG. 80. *Monopeltis perplexus.* Left, dorsal view, and right, ventral view at midbody to show segment arrangement and middorsal sulcus of AMNH 47732 from "Hanha or Capelongo," Angola.

The modified pectoral region extends to the ninth through the tenth dorsal annulus; there are six elongate and enlarged pectoral shields, though the lateral pairs may show partial fusion. The largest is the medial pair which is almost triangular and much the widest posteriorly where it forms a smooth anteriorly concave curve. The two lateral pairs may have more or less parallel sides and be partially fused. The lateralmost pair contacts four dorsal half-annuli, the next medial pair two additional ones, and a pair of lozenge-shaped shields flank the anterior tip of the medial pair and prolong it into the midventral portion of the fourth body annulus which is very much involved with the pectoral shields.

There are 261 to 270 body annuli, from the posterior edge of the third infralabial up to (but not including) the precloacal shields. Specimens have fewer than three supernumerary dorsal half-annuli, occurring mainly in the first and second 50 body annuli. A midbody annulus generally has 16 dorsal plus 14 to 16 ventral segments. At midbody the middorsal segments are approximately one to one and a-half times as long as wide and the midventral segments are slightly wider than long. The number of dorsal segments is slightly greater than the number of ventral segments for any given specimen.

There are generally four to five lateral annuli, the first one to three in contact with the outer of two pairs of enlarged precloacal shields. Precloacal pores are lacking.

The elongate subcylindrical tail is smooth and laterally compressed posterior to the autotomy annulus. There are 22 to 24 caudal annuli and autotomy occurs at the fifth to seventh. The caudal cap is covered with regular, somewhat enlarged segments, but the interannular sutures are much more shallow along the distal tip and the dorsomedial zone of the two to three adjacent annuli.

The lateral sulci are well marked, being as wide as an adjacent segment. There is a faintly indicated dorsal sulcus, whereas the ventral sulcus is only indicated by alignment of intersegmental sutures. The dorsal surface lacks diagonal folding lines.

Locality Records. ANGOLA: Hanha or Capelongo: AMNH 47731-47735 (Type series, Gans, 1975).
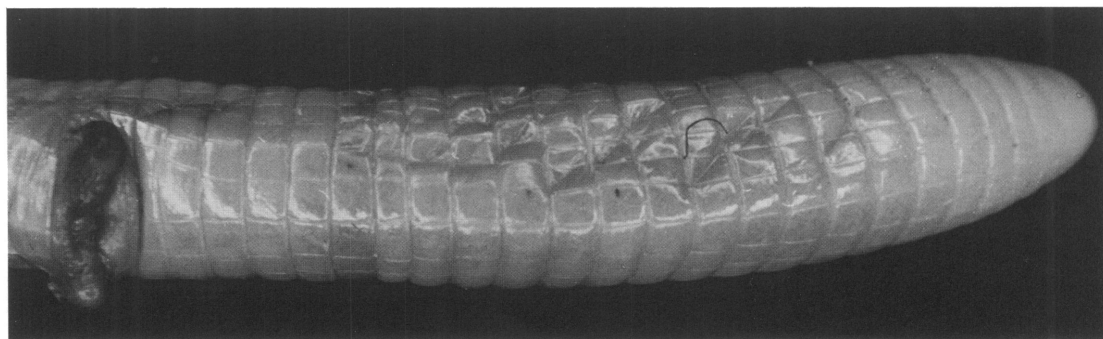
FIG. 81. *Monopeltis perplexus.* Ventral view of cloaca and tail to show rounded tip and autotomy zone of paratype AMNH 47731 from "Hanha or Capelongo," Angola.

Monopeltis remaclei Witte
Figures 82-85

Monopeltis remaclei Witte, 1933, p. 168. *Terra typica*: "Lukulu près de Kiambi," Zaire. Holotype: RGMC 8692.

Diagnosis. A large, stout (350 to 580 mm. snout-vent length) species of *Monopeltis* with the dorsal surface evenly darkened by a band of pigmentation that begins on the second fifth of the trunk length, extends ventrally beyond the lateral sulci, and is sharply concentrated on the dorsal surface of the caudal base after which it fades over the tip. The species has 251 to 285 body and 20 to 23 caudal annuli (up to the laterally narrowed tip), 21 to 34 dorsal plus 16 to 19 ventral segments to a midbody annulus, and three to five first and five to nine second postgenials, as well as an irregular number of rectangular segments in the postmalar position. The azygous head shields are paired (in one small specimen there is a narrow isthmus, apparently anomalous); the posterior one bears the indentations of the oculars. There are no pre-oculars. The nasals are short and do not contact the oculars, the lip or each other. There are four to six widened pectoral shields, the medial pair widest posteriorly and the lateral pairs showing irregular and asymmetrical fusions and sutures. They correspond to three dorsal body annuli, whereas the enlarged segments of the anterior pectoral region correspond to three additional annuli. The lateral sulci are clearly expressed, but neither dorsal nor ventral sulci are obvious.

Diagonal folding lines are numerous on the dorsal and lateral surfaces. There are almost no supernumerary dorsal half-annuli, but there is some irregularity of alignment in the first 100 body annuli. The dorsal interannular sutures cross the trunk at right angles to its long axis. Autotomy and precloacal pores are lacking.

Description. This is a stout large-sized species of *Monopeltis* with the available specimens ranging from 350 to 580 mm. in snout-vent length (fig. 20). The pigmentation of the dorsal surface is even, though some segments show blotching of the color and the intersegmental sutures may lack pigment. The band of dorsal pigmentation starts on the second fifth of the trunk, becomes gradually darker along the body, reaching the zone of densest pigmentation on the caudal base after which it fades so that the tip is unpigmented. The dorsal pigmentation fades within the first six segments ventral to the lateral annuli.

The dorsal surface of the head is covered by two heavily keratinized azygous head shields (except in RGMC 9313, fig. 82, the medial suture of which shows a slight asymmetrical fusion). The medial line of the anterior shield is slightly concave and that of the posterior shield markedly convex.

The eye is visible as a dark spot deep beneath the pentagonal ocular, that is in contact anteriorly with the first, dorsally with the second of the azygous shields, ventrally narrowly with the second and broadly with the third supralabial, and posteriorly sometimes with the first and
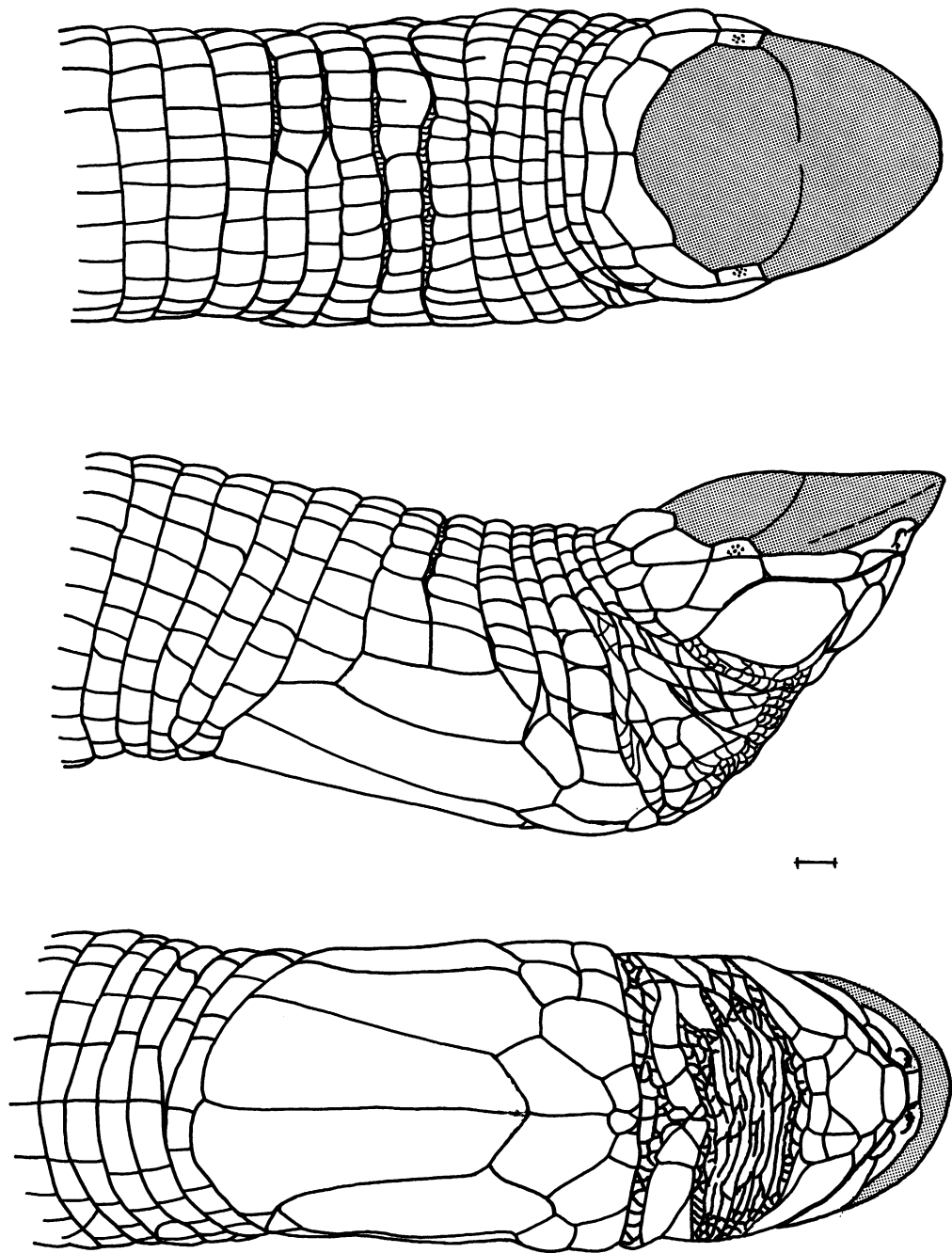
FIG. 82. *Monopeltis remaclei.* Pattern of head scalation. Dorsal, lateral, and ventral views of head and pectoral region of RGMC 9313 from Kabalo, Zaire. The line equals 1 mm. to scale.

always with the second of the six to 10 parietal segments. The latter link the third supralabials of each side and separate the posterior azygous head shield from the first body annulus.
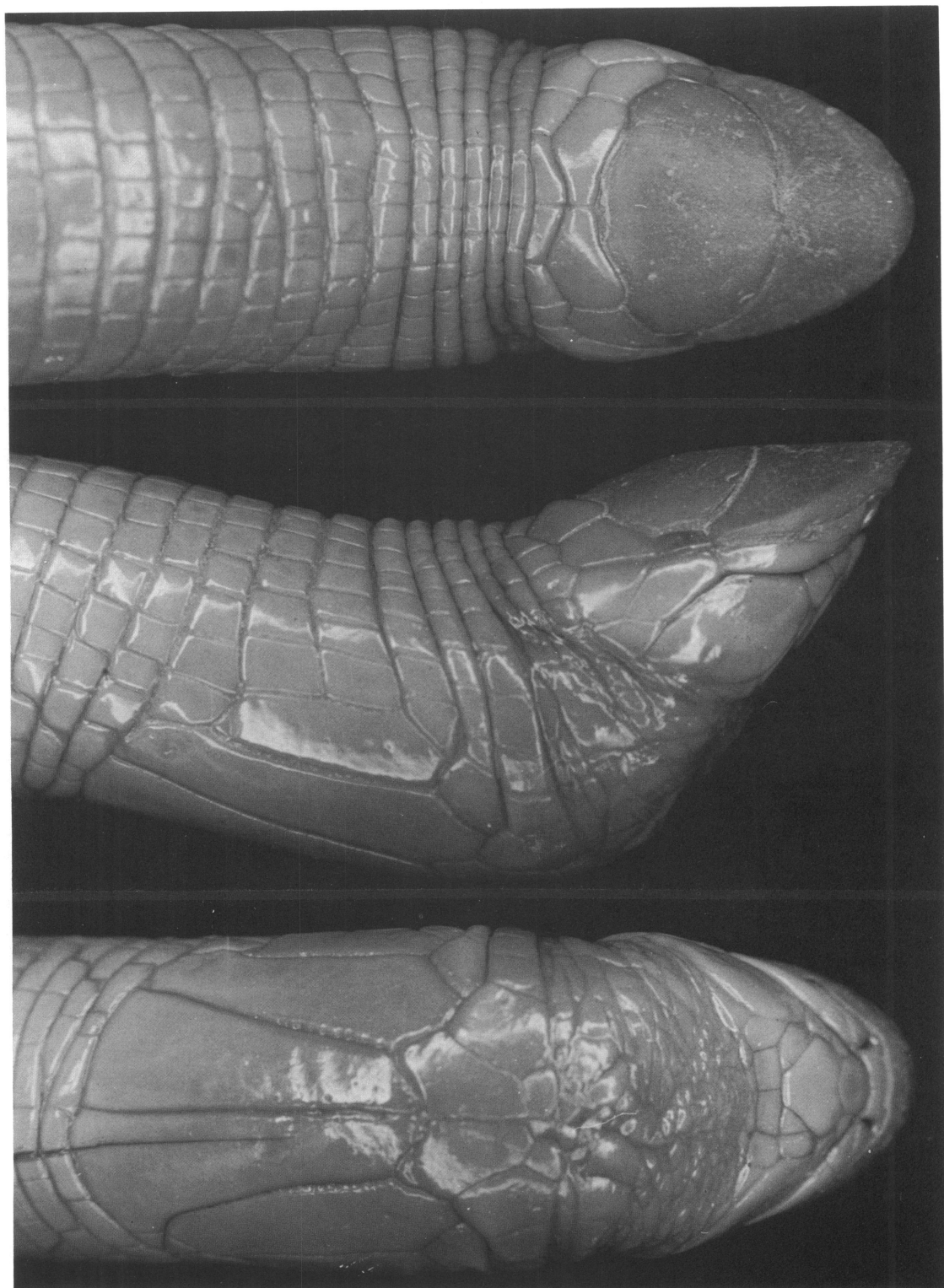
FIG. 83. *Monopeltis remaclei.* Dorsal, lateral, and ventral views of head of RGMC 9313 from Kabalo, Zaire. The marking on the right pectoral shield is a knife cut and hence an artifact.

The crescent-shaped nostrils are inserted in relatively short nasal segments that are well separated from the oculars, the lip and each other. There are four supralabials, the first very small, the second narrow but longest with its posterior tip keratinized in large specimens, and the third and fourth variably spaced (the latter two together with the most lateral parietals occupy the space taken by the enlarged third supralabials in most other spade-snouted species).

The lower jaw is covered by the squarish
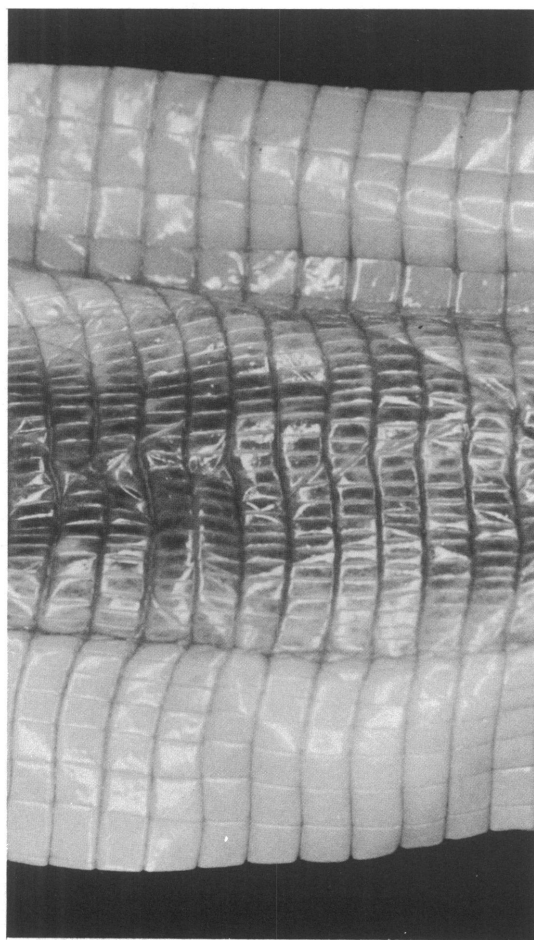
FIG. 84. *Monopeltis remaclei.* A view of stretched skin from midpart of the body of RGMC 9313 from Kabalo, Zaire to show the relative proportions of dorsal and ventral segments, their pigmentation and the position and expression of the lateral sulci.

mental with flaring anterior edges and an anteriorly concave posterior edge, the first, second, and enormous third infralabials, and the large heart-shaped postmental (genial) which is in broad contact with the first and second infralabials. The three to four segments of the first postgenial row do not contact each other medially, but are in only narrow contact with the second infralabials. The second row of postgenials contains four to six large segments between the medial aspects of the third infralabials plus a variably numbered row of tiny, irregular segments in the postmalar position just anterior to the deep gular fold.

The modified pectoral region extends to the ninth to tenth body annulus. There are usually six major elongate pectoral shields, corresponding to four dorsal half-annuli. The medial pair of pectoral shields is widest posteriorly, the next lateral widest anteriorly, and the lateralmost only as long as two to two and a-half annuli. The midventral segments of the two most anterior body annuli are significantly enlarged, particularly the medial pair that enfolds the medial pair of pectorals; these annuli are definitely involved in the formation of the pectoral shield. The shield zone extends posteriorly to displace the following body annuli which are narrower ventrally than dorsally.

There are 251 to 285 body annuli from the posterior edge of the last infralabial, up to (but not including) the cloacal shields. There are almost no supernumerary dorsal half-annuli, but some irregularity of alignment occurs in the first hundred body annuli. A midbody annulus has 21 to 34 (generally 21 to 25) dorsal plus 16 to 19 ventral segments. The middorsal segments are generally two to three times as long as wide and the midventral segments one to one and one-half times wide as long. The number of dorsal segments is for any given specimen consistently higher than the number of ventral segments.

There are generally four to five lateral annuli, the first two in contact with the outer of the four segments of the enlarged precloacal shield. There are no precloacal pores.

The long subcylindrical tail is smoothly rounded, but the distal portion shows some heightening and lateral compression anterior to the smoothly rounded tip. There are 20 to 23 caudal annuli, with no autotomy. The caudal cap
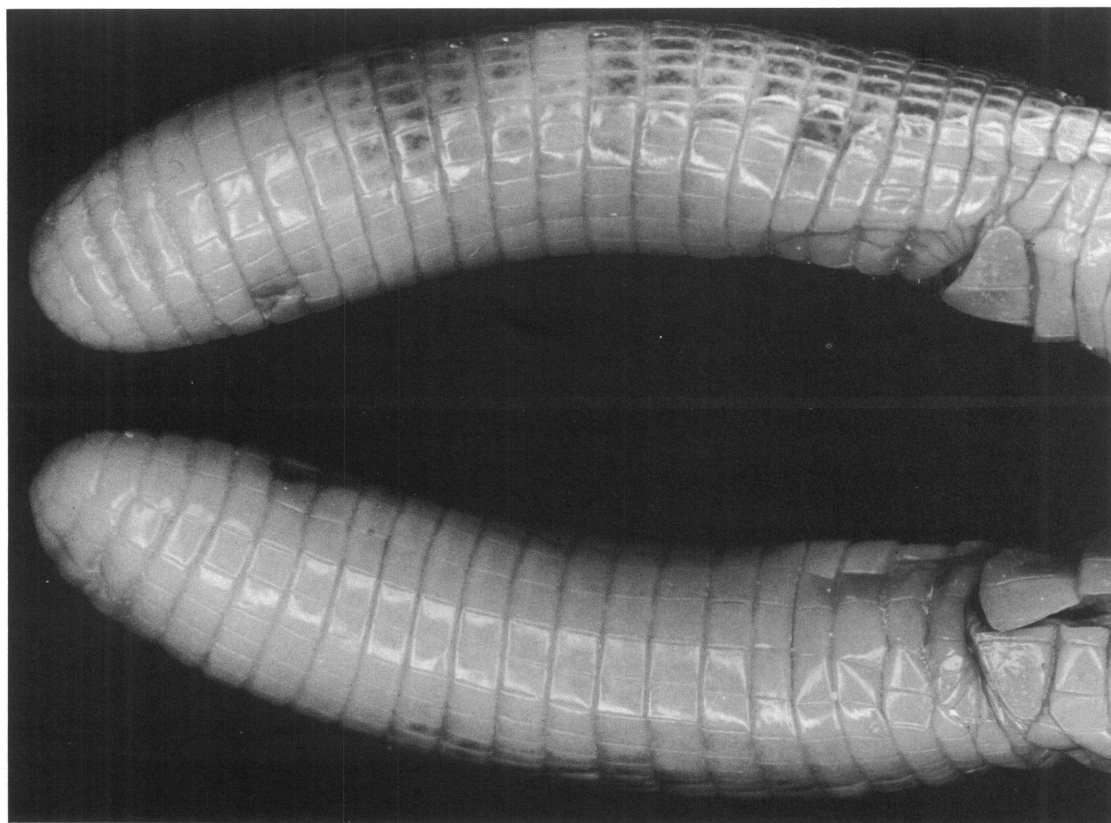
FIG. 85. *Monopeltis remaclei.* Lateral (top) and ventral (bottom) views of tail of RGMC 9313 from Kabalo, Zaire.

is covered with regular geometrical segments, although the intersegmental sutures are shallow.

The lateral sulci are narrow; only one half as wide as adjacent segments. The dorsal surface is crossed by many diagonal folding lines, but lacks a dorsal sulcus. The ventral sulcus is only indicated by alignment of intersegmental sutures.

Locality Records. ZAIRE: Lukulu (près de Kiambi): RGMC 8692 (Holotype: *M. remaclei* Witte, 1933, 1953, 1954; Witte and Laurent, 1942). Kabalo: RGMC 9313 (Witte and Laurent, 1942; Witte, 1953, 1954). Nyunzu: RGMC 9957, 9969 (Witte and Laurent, 1942; Witte, 1953, 1954).

Monopeltis adercae Witte
Figures 86-92

Monopeltis adercae Witte, 1953, p. 82. *Terra typica*: "Bukena près Mulongo (Distr. Haut Lomami) [altitude 617 meters]," Zaire. Holotype: IRScNB 2067.
Monopeltis adercai Laurent, 1956, p. 242. Emendation.

Diagnosis. A large (295 to 510 mm. snout-vent length) species of *Monopeltis* with the dorsal surface evenly darkened by a band of pigmentation that extends from the first 10 percent of the trunk up to and including the caudal tip, reaching ventral to the lateral sulci. The species has 300 to 302 body and 49 to 61 caudal annuli (up to the slightly swollen caudal tip), 28 dorsal and 16 to 18 ventral segments to a midbody annulus, and four first and six to eight second postgenials (no postmalars). The azygous head shields are paired; the ocular and a well-defined preocular lie anterior to the suture line. The nasals are short and do not contact the preoculars (or oculars), the lip or each other.
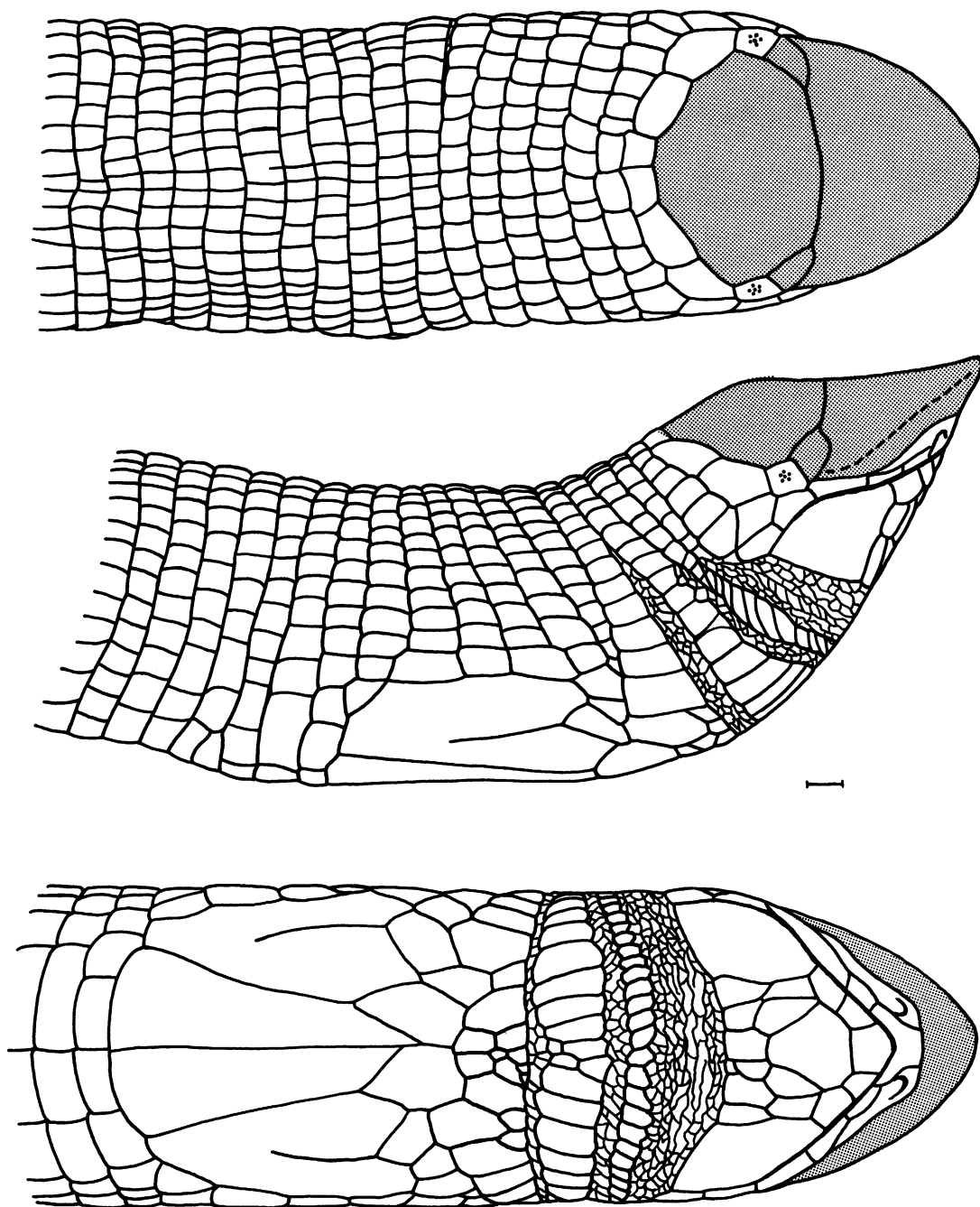
FIG. 86. *Monopeltis adercae*. Pattern of head scalation. Dorsal, lateral, and ventral views of head and pectoral region of the holotype IRScNB 2067 from Bukena, Zaire. The line equals 1 mm. to scale. (Modified after Witte, 1954.)
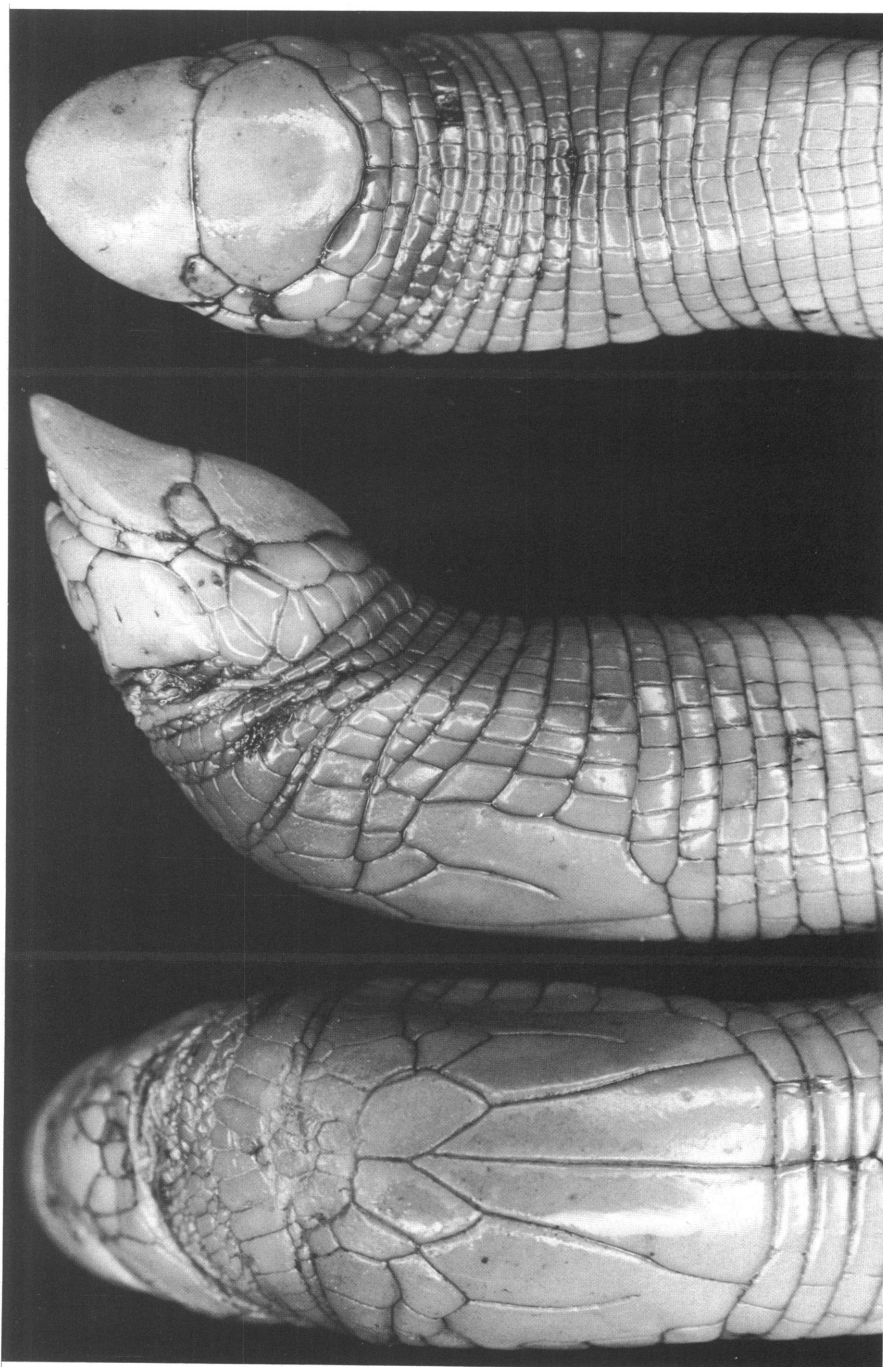
FIG. 87. *Monopeltis adercae*. Dorsal, ventral, and lateral views of head of the holotype IRScNB 2067 from Bukena, Zaire.
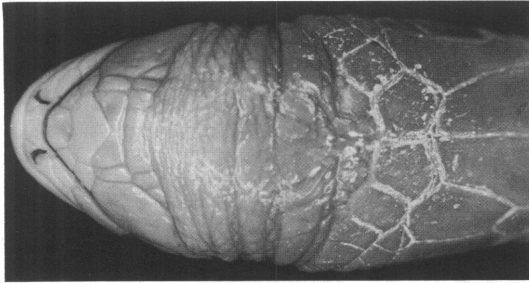
FIG. 88. *Monopeltis adercae*. Ventral view of head of RGMC 16881 from Manono, Zaire, to show chin segments.

There are six widened pectoral shields, the medial pair much the widest posteriorly and the lateral pairs showing irregular fusions and sutures. They correspond to four to five dorsal body annuli, whereas the enlarged segments of the anterior pectoral region correspond to three additional annuli. The lateral sulci are clearly expressed, but neither dorsal nor ventral sulci are obvious. Diagonal folding lines are numerous on the dorsal and lateral surfaces. Supernumerary dorsal half-annuli occur in the second 50 body annuli of one specimen; the other individual shows some irregularity of alignment in this zone. The dorsal interannular sutures cross the trunk at right angles to its long axis. Autotomy and precloacal pores are lacking. The dorsal segments of the tail are uniformly shorter than the distance between caudal annuli. Each is posteriorly limited by a series of parallel semicircular sutures that occupy almost 40 percent of the area between caudal annuli.

Description. This is a stout, large, and long-tailed species of *Monopeltis* with the two available specimens ranging from 295 to 510 mm. in snout-vent length (fig. 20). The dorsal surface is evenly pigmented although the larger specimen shows some blotching of the color, whereas intersegmental sutures and folds may lack pigment. The dorsal pigmentation starts posterior to the azygous shields and becomes gradually darker along the body, reaching the zone of densest pigmentation on the dorsal surface of the tail that is pigmented to its distal tip. The dorsal pigmentation fades at the level of the lateral sulci.

The dorsal surface of the head is covered by two heavily keratinized azygous head shields. The medial line of the anterior shield is slightly concave and that of the posterior shield convex.

The eye is visible as a dark spot deep beneath the subrectangular ocular, which is in contact anteriorly with the small convex and keratinized pre-ocular, dorsally with the second of the azygous shields, ventrally with the posterior tip of the elongate second, and the short third supralabial, and posteriorly with the first two of the eight parietal segments. The parietal segments link the third supralabials of each side and separate the posterior azygous head shield from the segments of the first body annulus.

The crescent-shaped nostrils are inserted in medium-sized nasal segments that are well separated from the oculars, the lip and each other. There are four supralabials, the first very small, the second narrow but longest with its posterior tip keratinized in large specimens, and the third and fourth variably spaced (the last two together with the most lateral parietals occupy the space taken by the enlarged third supralabials in most spade-snouted species).

The lower jaw is covered by the squarish mental with flaring anterior edges and an anteriorly concave posterior edge, the first, second, and enormous third infralabials, and the large heart-shaped postmental (genial) which is in
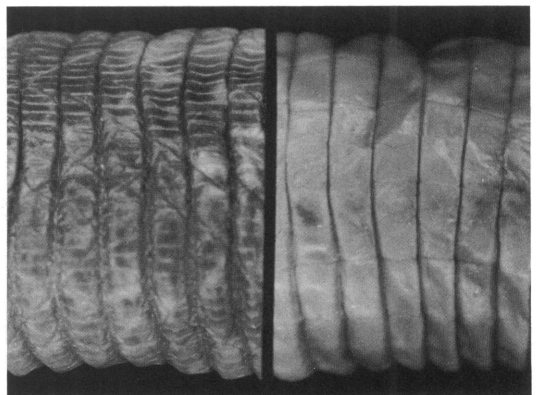

FIG. 89. *Monopeltis adercae*. Left, dorsal view, and right, ventral view at midbody to show segment proportions and pigmentation details of RGMC 16881 from Manono, Zaire.
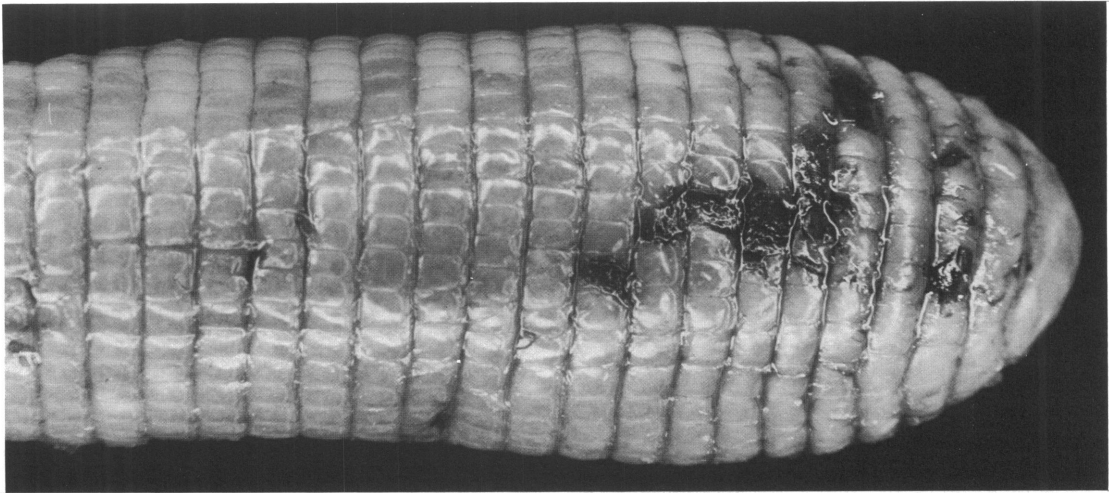
FIG. 90. *Monopeltis adercae.* Dorsal view of tail of holotype IRScNB 2067 from Bukena, Zaire, to show shape and pigmentation.

broad contact with the first and second infralabials. The lateral segments of the first postgenial row are rectangular, and contact the second infralabials but have only point contact with the postmental. The triangular and medial first postgenials have point contact with the second infralabial and narrow contact with each other on the midline posterior to the postmental. The second postgenial row is wider than the first and comprises six to eight segments just anterior to the deep gular fold.

The smooth and modified pectoral region extends to the tenth or eleventh body annulus. There are six major elongate pectoral shields, corresponding to three to five dorsal half-annuli. The medial pair of pectorals is widest posteriorly and the lateral one irregularly subdivided. The midventral segments of the three preceding body annuli are significantly widened, particularly the medial pair, which is in blunt contact with the medial pair of pectorals of which they form an anterior prolongation; these anterior annuli are definitely involved in the formation of the pectoral shield. The next anterior annulus is also much the widest medially, but is separated from the shield by a row of tiny segments (lining the gular fold).

There are 300 to 302 body annuli from the posterior edge of the last infralabial, up to (but not including) the cloacal shield. There are eight supernumerary dorsal half-annuli in the second 50 body annuli in one specimen; the other shows some irregularity of alignment in this zone. A midbody annulus has 28 dorsal and 16 to 18 ventral segments. The middorsal segments are generally twice as long as wide and the midventral ones twice as wide as long. The number of dorsal segments is greater than the number of ventral segments.

There are four to five lateral annuli, the first two in contact with the outer segments of the three pairs on the enlarged precloacal shield. There are no precloacal pores.

The very long tail is smoothly rounded and slightly swollen in its oval distal portion anterior to the smoothly rounded tip. There are 49 to 61 caudal annuli, with no autotomy. The segments of the caudal cap tend to fuse into each other and sutures, including those defining the terminal annulus, tend to be shallow or obliterated.

The lateral sulci are very narrow; they are only one-half as wide as an adjacent segment. The dorsal surface is crossed by many diagonal folding lines, but lacks a dorsal sulcus. The ventral sulcus is only indicated by alignment of intersegmental sutures.

Locality Records. ZAIRE: Bukena (617 m.) près de Mulongo, distr. Haut Lomami: IRScNB

FIG. 91. *Monopeltis adercae*. View of caudal tip of RGCM 16881 from Manono, Zaire, to show terminal segment.

2067 (Holotype *M. adercae* Witte, 1953, 1954). Manono: RGMC 16881 (Laurent, 1955, 1956).

Monopeltis scalper (Günther)
Figures 93-97

Phractogonus scalper Günther, 1876, p. 678. *Terra typica*: "Angola" in error: actually "Kilemba in Urua" (=Kilembe, lat. 7°40′S, long. 26°03′E, Zaire). Holotype: BM 76.7.1.2:RR1946.8.9.1.

Lepidosternon scalprum: Strauch, 1881, col. 124. Emendation.

Monopeltis gerardi Boulenger, 1913, p. 392. *Terra typica*: "Kikondja (Katanga)," Zaire. Holotype: RGMC 1201.

Monopeltis scalper bulsi Laurent, 1954, p. 68. *Terra typica*: "Kamina, Haut Lomami," Zaire. Holotype: RGMC 16179. Paratypes: RGMC 15917, 16015, 16016, 16178.

Diagnosis. A small to medium-sized (212 to 290 mm. snout-vent length in adults) species of *Monopeltis* with the dorsal surface darkened variably by continuous pigmentation that extends ventrally to a few segments below the

lateral sulci and reaches from the nuchal region (where it tends to be concentrated in the segmental centers) to across the caudal tip where it is densest. The species has 191 to 225 body and 13 to 18 caudal annuli (up to the vertically oval caudal tip), 13 to 19 (generally 14 or 16) dorsal and 11 to 18 (generally 12 or 14) ventral segments to a midbody annulus, and generally four (rarely five) segments to the postgenial row and six to 12 segments to the postmalar one. The two azygous head shields are discrete in juveniles, fused in the specimens of greater than 115 mm. snout-vent length (except in two specimens from Kikondja in which they remain discrete). The fused zone occupies more than the medial third. The oculars are generally tiny triangles lying just posterior to the edges of the sutures. There are no preoculars. The nasals are short and generally do not contact the oculars, the lip, or each other. (Four specimens from Kikondja have larger oculars, and discrete preoculars. One from Bukena has the nasal and first supralabial fused azygously.) The pectoral zone is relatively short and wide, and occupied by four to six elongate shields the medial pair of which is widest posteriorly, the next lateral pair extends farther anteriorly and the lateralmost pair is irregularly and often asymmetrically subdivided. These shields correspond to four or five dorsal half-annuli, whereas one or two additional half-annuli correspond to the enlarged segments of the anterior pectoral region. There is a little

FIG. 92. *Monopeltis adercae*. Detail of dorsal surface of RGMC 16881 from Manono, Zaire, to show multiple parallel semicircular interannular sutures.
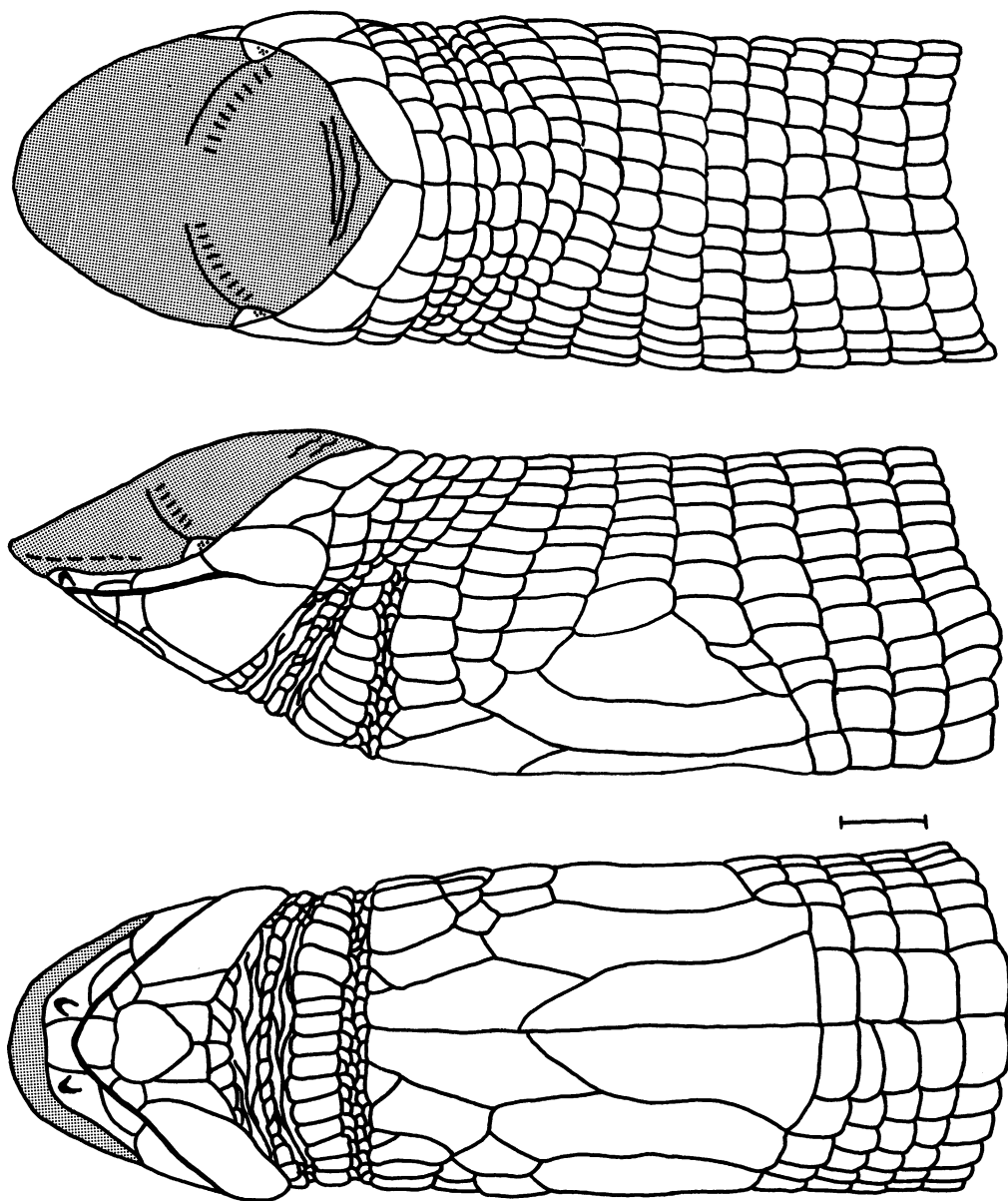
FIG. 93. *Monopeltis scalper.* Pattern of head scalation. Dorsal, lateral, and ventral views of head and pectoral region of RGMC 5757, from Mabwe, Zaire. The line equals 1 mm. to scale.

diagonal folding on the dorsal surface. The first 50 ventrals correspond to 11 (seven for one Kikondja specimen) to 20 supernumerary dorsal half-annuli; the next may have up to nine, and the more posterior ones never more than one. Dorsal interannular sutures cross the trunk at right angles to its long axis. Two precloacal pores lie on segments lateral to the cloacal cap, which is formed of three to four large shields. Autotomy occurs at the third to seventh caudal annulus.

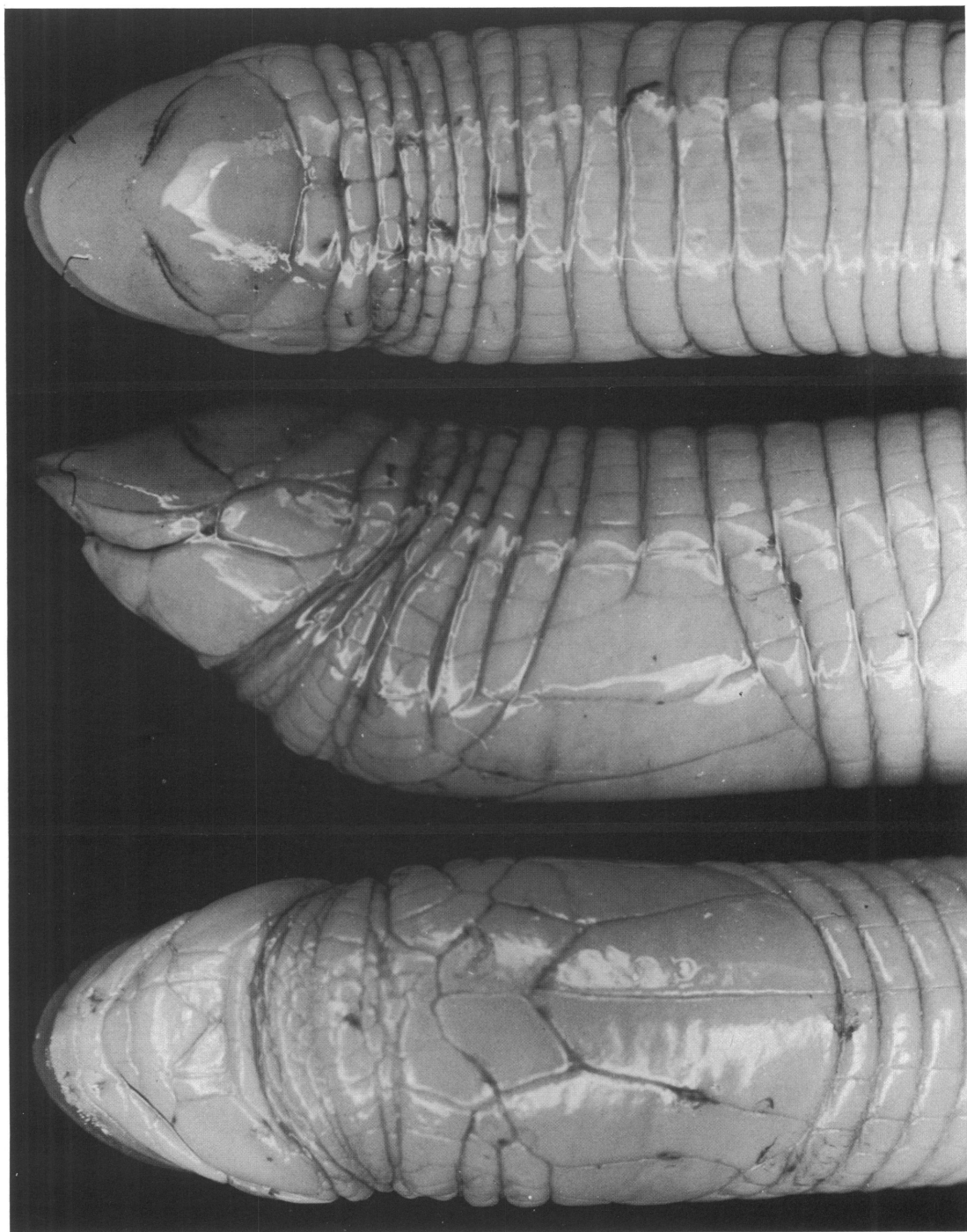*Description.* This is a small to medium-sized species of *Monopeltis* with the available speci-

FIG. 94. *Monopeltis scalper.* Dorsal, lateral, and ventral views of head of RGMC 16179, holotype of *M. scalper bulsi*, from Kamina, Zaire.

mens ranging from 88 to 290 mm. in snout-vent length (fig. 20). The dorsal surface is darkened variably by continuous pigmentation that extends ventrally to the vicinity of or below the lateral sulci, where it fades gradually and reaches from the nuchal region, where the pigment tends to be concentrated in the segmental centers, across the dorsal surface, becoming gradually denser toward the tail, and showing maximal pigmentation just caudal of the autotomy constriction. The pigmentation may be blotched irregularly and some of the intersegmental sutures may be lightened. While the pigmented zone often starts on the parietals and may then disappear to start again near the fiftieth body annulus, the head shields and segments never show discrete melanophores. The ventral surface of the tail is lightly shaded in a few individuals and heavily marked only rarely.

The dorsal surface of the head is divided into two large, heavily keratinized, azygous head shields that may have started to fuse in specimens of greater than 150 mm. snout-vent length, ultimately forming an isthmus across the medial third of the raphe. The dorsal surface of the anterior shield is slightly concave and that of the posterior is convex along the midline. The preocular regions are concave and the posterior convex in transverse section.
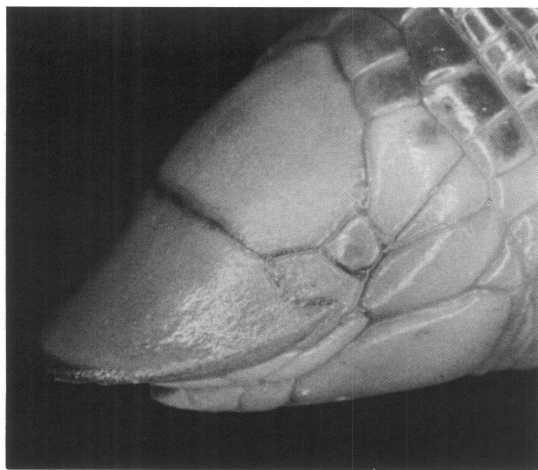

FIG. 95. *Monopeltis scalper.* Oblique view of head of NMW 12352:1 from Kikondja, Zaire, to show preocular.
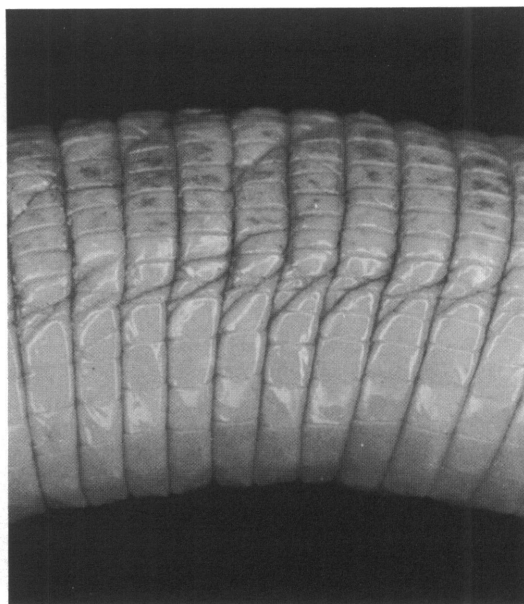

FIG. 96. *Monopeltis scalper.* Lateral view at midbody showing lateral sulcus as well as segment arrangement and pigmentation of RGMC 16179 from Kamina, Zaire.

There are no preoculars (except in the specimens from Kikondja, the characteristics of which are mentioned in parentheses below. The preoculars here are nonkeratinized and inserted into the anterior of the azygous shields). The size, shape, and even occurrence of the ocular and other segments of the postnasal region are most asymmetrically variable in this assemblage. The eye is generally visible as a dark spot deep beneath the triangular to pentagonal and variably sized ocular (fused unilaterally to the azygous in RGMC 5764, and on both sides in RGMC 5766), which is in contact dorsally with the second azygous shield, anteriorly with the first (or the preocular), anteroventrally with the nasal or not,[1] ventrally with the supralabial, and posteriorly with the medial part of the enormous third supralabial or with the anterior edge of the four to six parietals that span from the third supralabials to contact each other on the dorsal midline, thus

[1] The appearance of RGMC 5762 suggests that the posterior tip of the nasal-postnasal may be overgrown with keratin and thus incorporated into the azygous shield.

FIG. 97. *Monopeltis scalper.* Lateral and ventral views of cloaca and tail of RGMC 16179 from Kamina, Zaire.

separating the posterior edge of the azygous head shields from the first body annulus. A tiny triangular segment may insert into the posterior half of the suture between the lateralmost parietal and the third supralabial.

The crescent-shaped nostrils are inserted in medium-sized nasal segments. They or the postnasals may or may not reach the ocular (but reach around the keratinized posterolateral wings of the anterior azygous shield to contact the preoculars). Medially the nasals are well separated from each other and from the lip. There are three supralabials, the first one tiny, the second the longest, and the third largest and the tallest.

The lower jaw is covered by the wide mental with flaring anterior sides and an almost straight

raphe with the even wider postmental, by the small first, second, and enormous third infralabials, and the squat and wide postmental (genial), which extends only slightly posterior to the level of the second infralabials. The elongate, rectangular lateral segments of the first postgenial row are generally in point contact with the postmental and the medial pair of segments is in very broad contact posterior to the obtuse apex of the postmental. There are six to 10 much smaller segments to the second postgenial row just anterior to the gular folds.

The modified pectoral region extends to the eighth or ninth body annulus. There are usually six major elongate subparallel pectoral shields, corresponding to four dorsal half-annuli. The

medial pair is 50 percent wider posteriorly than anteriorly, the second pair is widest anteriorly, and the lateralmost pair is short and contacted only by two dorsal half-annuli. One intercalated dorsal half-annulus precedes this series. The next most anterior annulus is much widened medially and contributes a pair of large elements that forms an anterior prolongation of the smoothened medial row. The annulus is clearly involved in the pectoral zone. The shield zone extends slightly posteriorly to displace the following annuli, which are narrower ventrally than dorsally.

There are 191 to 225 body annuli from the posterior edge of the third infralabial up to (but not including) the cloacal shield. There are seven to 20 supernumerary dorsal half-annuli in the first 50 body annuli, up to nine in the second, and never more than one thereafter. A midbody annulus has 13 to 18 (generally 14 to 16; 17 to 19 at Kikondja) dorsal, plus 11 to 14 (generally 12 or 14; 18 at Kikondja) ventral segments. The dorsal segments at midbody are approximately one and one-half times as long as wide and the ventral twice as wide as long. The number of dorsal segments is equal to or slightly larger than the number of ventral ones for any given specimen.

There are generally four to five caudal annuli, the first two to three in contact with the small pore-bearing segments that flank the precloacal shield. The shield proper consists of four large segments of which the medial pair is slightly the largest. There are two precloacal pores.

The medium subcylindrical tail is rounded, somewhat increased in height posterior to the autotomy constriction and slightly reduced in height over the last four caudal annuli. There are 13 to 18 caudal annuli, autotomy occurring at the third to seventh. The smoothly rounded caudal cap lacks segmentation and the intersegmental and interannular raphes of the immediately preceding region are very shallow.

The lateral sulci are well defined but narrow and only as wide as one-half of an adjacent segment. There are no dorsal nor ventral sulci and only a limited number of diagonal folding lines.

Locality Records. ZAIRE: Bukena, 617 m.: IRScNB 5766 (Witte, 1953, 1954). Kilembe: BM 76.7.1.2:1946.8.9.1 (Holotype *M. scalper* Gün-

ther, 1876; Boulenger, 1885). Kikondja: *MD (four specimens), (Laurent, 1964); NMW 12352 (two specimens); RGMC 1201 (Holotype of *M. gerardi* Boulenger, 1913), 1588 (Witte, 1954). Manono: RGMC 16879 (Laurent, 1956). Upemba National Park (Laurent, 1954); Mabwe, 585 m.: CG 1823; IRScNB 5757-5758, 5760-5761 (Witte, 1953, 1954); Munoi, 890 m.: IRScNB 5764 (Witte, 1953, 1954): Sanga, 700 m.: IRScNB 5765 (Witte, 1953, 1954); Kanonga, 695 m.: IRScNB 5762, 5763a, 5763b (Witte, 1953, 1954). Kamina: RGMC 15917, 16015-16016, 16178 (Paratypes *M. s. bulsi* Laurent, 1954), 16179 (Holotype *M. s. bulsi* Laurent, 1954), (Witte, 1954; Witte and Laurent, 1942).

Monopeltis vanderysti Witte
Figures 98-102

Monopeltis vanderysti Witte, 1922, p. 66. *Terra typica*: "Wombali; Leverville (dist. du Kwango); Lac Leopold II; Kasai," Congo; restricted to "Wombali (dist. Lac Leopold II)," Zaire (Gans, 1967). Lectotype (Gans, 1967): RGMC 1872. Lectoparatypes: RGMC 897 (Lac Leopold II); RGMC 962 (Kasai); RGMC 2309 (Leverville, Kwango).

Monopeltis lujae Witte, 1922, p. 67. *Terra typica*: "Lubue," Kwilu District, Kasai, Zaire. Holotype: RGMC 505.

Monopeltis vanderysti vilhenai Laurent, 1954, p. 66. *Terra typica*: "Dundo," Angola. Holotype: RGMC 17530 (formerly MD 5040). Paratypes: MD 5183, 5242; RGMC 17504.

Monopeltis vanderysti closei Laurent, 1954, p. 68. *Terra typica*: "Kahemba, Kwango District, Congo Belge," (Zaire). Holotype: RGMC 14702 (14502 in error). Paratypes: RGMC 11953; also RGMC 14581, doubtfully from Leopoldville.

Diagnosis. A medium-sized (220 to 346 mm. snout-vent length) species of *Monopeltis* with the last two-thirds of the dorsal surface faintly pigmented by a web of melanocytes diffusely scattered and concentrated in the segmental edges. The pigmentation tends to become more pronounced in larger specimens, as well as on the dorsal surface of the tail. Some specimens also show pigmentation of the caudal tip and its ventral surface. The species has 219 to 241 body and
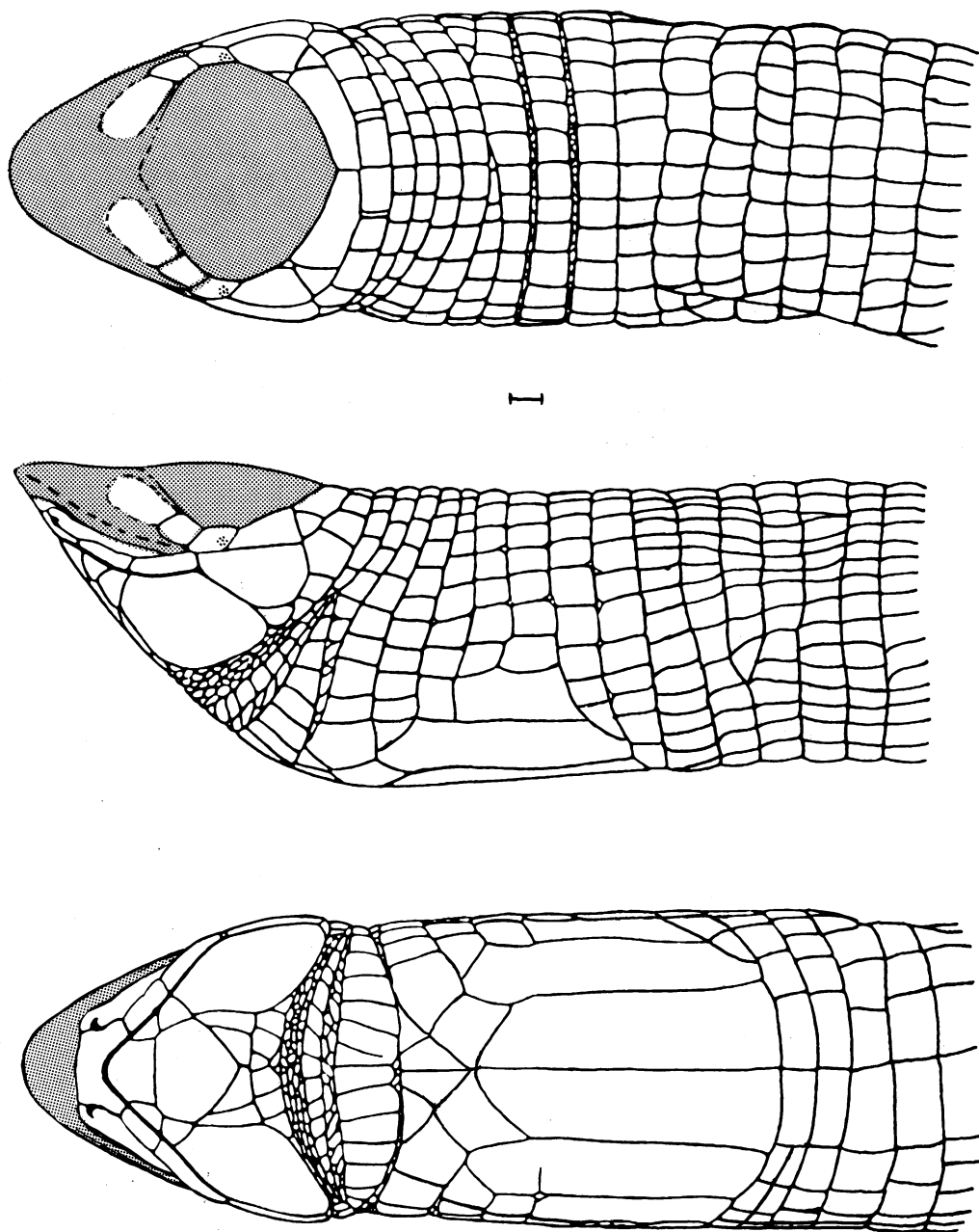
FIG. 98. *Monopeltis vanderysti.* Pattern of head scalation. Dorsal, lateral, and ventral views of head and pectoral region of USNM (unnumbered) from Sanza Pombo, Angola. The line equals 1 mm. to scale.

13 to 17 (generally 15 or 16) caudal annuli (up to the swollen and then laterally compressed tip), 18 to 23 (generally 20 or 22) dorsal and 14 to 16 (generally 14) ventral segments to a midbody annulus, as well as two to four first (sometimes in an interrupted row) and six to 11 (generally
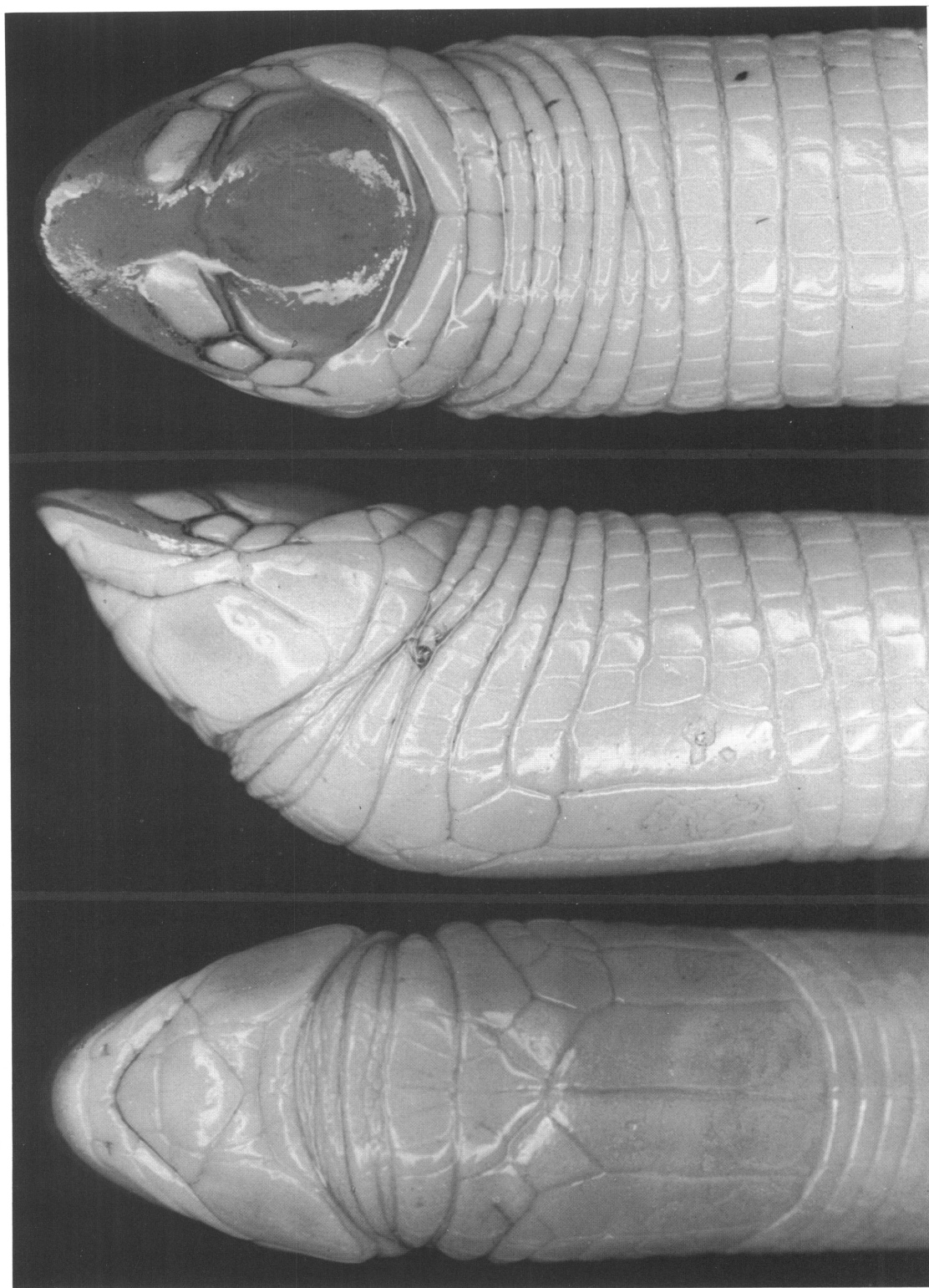
FIG. 99. *Monopeltis vanderysti*. Dorsal, lateral, and ventral views of head and anterior body of RGMC 897 from Lac Leopold II, Zaire. Note keratinization in specimen of 282 mm. snout-vent length.
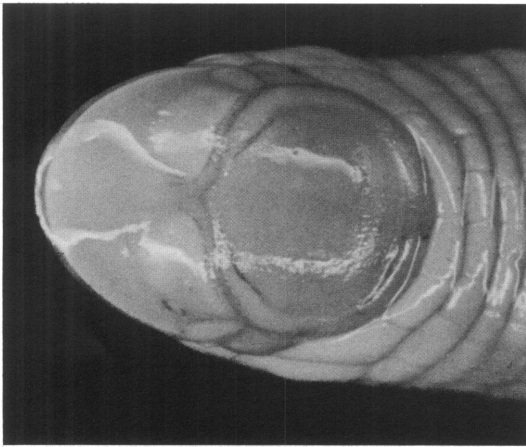
FIG. 100. *Monopeltis vanderysti.* Detail of head of smaller (snout-vent length 268 mm.) specimen RGMC 2704 from Ipamu (Kwilu District), Zaire, to show reduced keratinization.

seven to nine) second postgenial segments. The azygous head shields are paired in hatchlings. In adults an isthmus of keratin fuses over the medial 20 percent of the suture. The large oculars and preoculars, as well as a variable rounded zone lying anteromedial to these remain unkeratinized. This gives the adults a diagnostic dumbbell-shaped zone of keratinization. The nasals are elongate; although they do not contact each other or the lip, they do send long posterior wings along the head shield that contact the preocular in perhaps half the specimens. Six elongate shields form the pectoral region and correspond to four, sometimes five, dorsal half-annuli. The two to four medial and ventral segments of the next anterior annulus are enlarged and tend to interdigitate between the shields. Lateral sulci are clearly expressed, whereas dorsal and ventral ones are absent. The dorsal surface is crossed by numerous diagonal folding lines. Up to seven (generally fewer) supernumerary dorsal half-annuli occur in the second 50 body annuli, fewer in the first, and most specimens lack them thereafter. The interannular sutures cross the trunk at right angles to its long axis. There are no precloacal pores. Caudal autotomy occurs at the third to fifth, generally the fourth, caudal annulus.

Ontogenetic Variation. The keratinization pattern of the cephalic shields proceeds in a regular sequence. Hatchling specimens (90 mm. snout-vent) have two discrete azygous head shields. The transverse suture shows a characteristic medial and anteriorly pointing diverticulum. Keratinization starts in a half-moon-shaped zone fringing the edge of the spade.

A secondary center of keratinization forms in the middle of the second head shield. This zone expands radially, and the anterior crest extends posteriorly. An isthmus of keratinized surface then reaches posteriorly from the center of the convexity toward the diverticulate suture. This is reached at a length of about 200 mm. and the keratinized zone first spreads laterally along the anterior edge of the suture before crossing this to join the middle of the second center (215 mm.).

Keratinization then continues and the anterior half of the first and most of the second shield become heavily keratinized. The isthmus remains narrow (even in 300 mm.-plus specimens it rarely exceeds 20 percent of the width), whereas the anterior edge of the preocular may become covered, the swollen zone anteriomedial to this
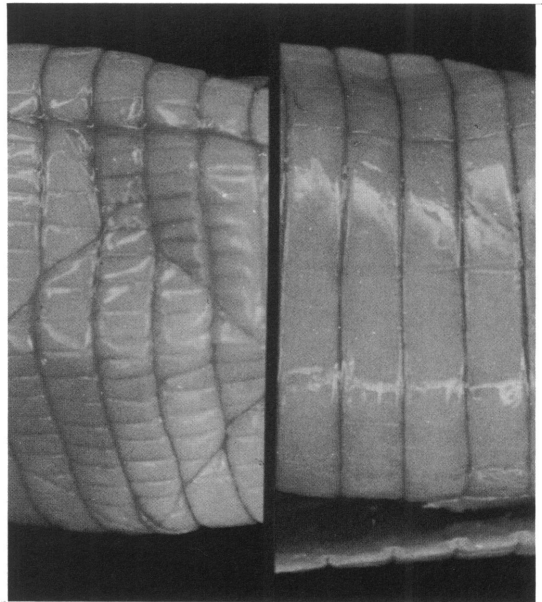

FIG. 101. *Monopeltis vanderysti.* Dorsal and ventral views of midbody of RGMC 897 from Lac Leopold II, Zaire.
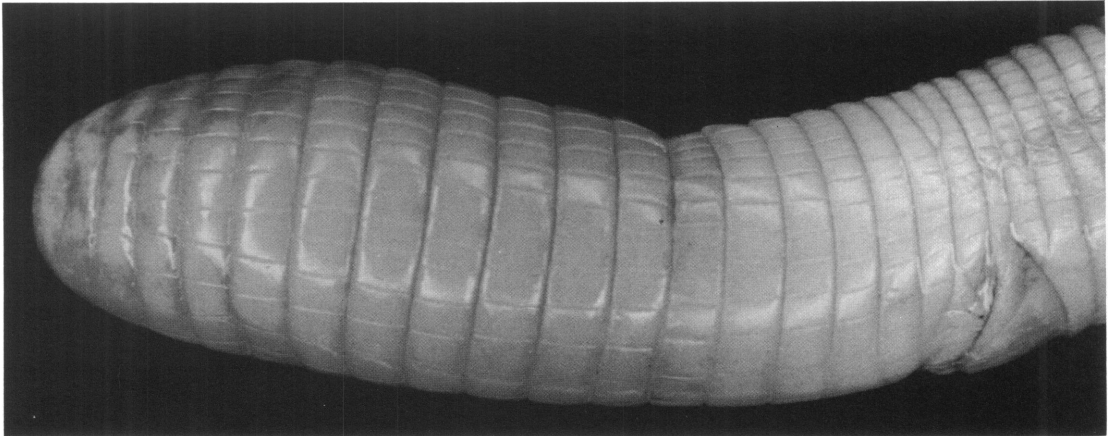
FIG. 102. *Monopeltis vanderysti*. Lateral view of tail of RGMC 897 from Lac Leopold II, Zaire. Note autotomy annulus.

remains bare and continues to define an isthmus. Yet this zone does not represent a discrete scale; in hatchlings it is contiguous with the remainder of the anterior shield.

Description. This is a medium-sized species of *Monopeltis* with the available specimens ranging from 96 to 346 mm. in snout-vent length (fig. 20). The last two-thirds of the dorsal surface are pigmented by a web of melanophores that are generally scattered, but tend to be concentrated along the segmental edges. The pigmentation tends to be more pronounced in larger specimens, as well as on the dorsal and the ventral surface of the tail and the caudal tip.

The dorsal surface of the head is divided into two azygous head shields by an undulating suture that comes to an anterior point along the midline. The anterior shield is faintly concave along the midline; the posterior is convex. In transverse section the posterior shield is markedly convex, whereas the preocular region and the crescentic zones anterolateral to the transverse suture are depressed. As discussed under Ontogenetic Variation, the keratinization proceeds progressively. The anterior spade only is keratinized in a hatchling (RGMC 21140). Slightly later, the posterocentral region of the anterior shield and the central region of the posterior became keratinized. An isthmus gradually closes the suture between anterior and posterior shields (ultimately obliterating its medial third) and the medial keratini-

zation spreads to include all of the posterior shield. The preocular keratinizes last and before this another portion on each side of the crescentic space anterior to the division. Although these open areas give the impression that there are discrete shields anterior to the preoculars, rather they represent unkeratinized depressions in the anterior shield and are never defined by peripheral raphes. Even when the preoculars are not keratinized their raphes and margins suggest a narrow strip of keratinization.

The squarish preoculars occupy the posteromedial corners of the anterior shield. The eyes are faintly visible beneath the pentagonal oculars that occupy the corners between the wider anterior shield. They are in contact dorsally with the posterior azygous shield, anterodorsally with the preocular, ventrally with the second and third supralabials, and posteriorly with the lateralmost of the four to six parietals that span dorsally between the third supralabials thus, separating the posterior of the azygous head shields from the first body annulus.

The crescent-shaped nostrils are inserted in medium to large-sized nasal segments that may approach, but rarely reach the oculars, and never the lip or each other. There are three (to five) supralabials, the first tiny, the second the longest (or subdivided), and the third the largest and tallest.

The lower jaw is covered by the wide mental

with flaring anterior edges and an almost straight raphe with the even wider postmental, by the small triangular first, larger second, and enormous third infralabials, and by the squat heart-shaped pentagonal postmental (genial). The two to four postgenials of the first row are variable in shape, size, and arrangement, thus the postmental may contact the third infralabial, or be separated from this by elongate rectangular lateral postgenials. The median pair of segments is generally subtriangular, but varies in the amount of medical contact posterior to the obtuse postmental apex. There are six to 11 irregular segments to the second postgenial row that lies anterior to the deep gular fold.

The modified pectoral region extends to the seventh through the ninth (generally to the eighth) body annulus. There are usually six major elongate subparallel pectoral shields, the lateral pairs of which may show irregularities or fusions, corresponding to three or four dorsal half-annuli. The median pair is subtriangular, much wider posteriorly than anteriorly, the second pair is widest anteriorly and the lateralmost pair is short and contacted only by two to three dorsal half-annuli. One intercalated dorsal half-annulus precedes this series. The next more anterior annulus is much widened medially and contributes a series of large elements two of which form an anterior prolongation of the smoothened medial row of shields. This annulus is clearly involved in the pectoral zone. The posterior edge of the shield zone is almost transverse; only the immediately following annuli are slightly narrower ventrally than dorsally.

There are 219 to 241 body annuli from the posterior edge of the third infralabial up to (but not including) the cloacal shield. Up to seven (generally fewer) supernumerary dorsal half-annuli occur in the second 50 body annuli, fewer in the first, and most specimens lack them thereafter. A midbody annulus has 18 to 23 (generally 20 to 22) dorsal plus 12 to 16 (generally 14) ventral segments. The midbody dorsal segments are approximately twice as long as wide and the ventral ones two and one-half to three times as wide as long. The number of dorsal segments is greater than the number of ventral segments for any given specimen.

There are three to six (generally four to five) lateral annuli. The first two or three are in con-

tact with the lateral segments of the precloacal shield, which is covered by four large segments, the medial pair the widest. There are no precloacal pores.

The short, stout and swollen subcylindrical tail is rounded, somewhat increased in height posterior to the autotomy constriction, may tend to curve slightly ventrad thereafter, and also shows significant lateral compression near its distal tip. Its height becomes somewhat reduced over the last four to six of the 13 to 17 (generally 15 or 16) caudal annuli. Autotomy occurs at a very significantly narrowed third to fifth (generally the fourth) annulus. The vertically oval terminal cap is small and a distal view of the tail shows concentric annular ovals.

The lateral sulci are strongly marked and as wide as an adjacent segment. There are neither dorsal nor ventral sulci, however the dorsal surface has some diagonal folding lines in a short and narrow zone at midbody.

Locality Records. ZAIRE: Mayombe: RGMC 14503 (Laurent, 1947; Witte, 1954). Lemfu: RGMC 2715 (Witte, 1954; Witte and Laurent, 1942). Kinshassa (doubtful, Laurent, 1954): RGMC 14581 (Laurent, 1952; Paratype of *M. v. closei* Laurent, 1954; Witte, 1954). Uele, Ituri (doubtful): RGMC 11455 (Witte, 1954; Witte and Laurent, 1942). Wombali: RGMC 1872 (Lectotype of *M. vanderysti* Witte, 1922, 1954, see Gans, 1967; Witte and Laurent, 1942). Lac Leopold II: RGMC 897 (Lectoparatype of *M. vanderysti* Witte, 1922, 1954; Witte and Laurent, 1942). Bokoro: RGMC 16554 (Laurent, 1953). Kasai: RGMC 962 (Lectoparatype of *M. vanderysti* Witte, 1922, 1954; Witte and Laurent, 1942). Makaw on Kasai River: RGMC 21139-21140. Ipamu (Kwilu District): RGMC 2704 (Witte, 1954; Witte and Laurent, 1942). Lubue (Kwilu District): RGMC 505 (Holotype of *M. lujae* Witte, 1922, 1954; Witte and Laurent, 1942). Banningville: RGMC 15653. Leverville RGMC 2309 (Lectoparatype of *M. vanderysti* Witte, 1922, 1954); RGMC 5979-5982, 6142, 6223-6224 (Laurent, 1947; Loveridge, 1941; Witte and Laurent, 1942). Nolinga: RGMC 16371. Kahemba: RGMC 14702 (Holotype of *M. v. closei*), 11953 (Paratype of *M. v. closei* Laurent, 1954; Witte, 1954; Witte and Laurent, 1942).

ANGOLA: Sanza Pombo: USNM (unnum-

bered). Dundo: RGMC 17503 (ex MD 5040, Holotype of *M. v. vilhenai*); *MD 5183, 5242; RGMC 17504, ex MD 5233 (Paratypes of *M. v. vilhenai* Laurent, 1954); *MD 5246, 5248, 5832, 5930, 5951, 5960, 11367-3 (Laurent, 1964).

Biological Miscellanea: At Dundo, some specimens were taken in agricultural plantations.

Monopeltis luandae Gans
Figures 103-106

Monopeltis luandae Gans, 1976, p. 3. *Terra typica*: "Luanda on the road to the Quanza river mouth, Angola." Holotype: AMNH 111338. Paratypes: CG 5219 (airport, Luanda), USNM 20037-20038 ("Loanda").

Diagnosis. A small to medium-sized (203 to 385 mm. snout-vent length) species of *Monopeltis* with the (apparently faded) dorsal surface of the trunk and tail speckled with dark pigment that fuses into an accentuated area on the dorsal surface of the tail. The species has 223 to 227 body and 15 or 16 caudal annuli (up to the oval tip that shows some lateral compression), 29 to 36 (generally 30 or 32) dorsal and 14 to 20 ventral segments to a midbody annulus, and four first plus five to eight second postgenial segments. The azygous head shields are discrete at 218 mm. snout-vent length, and show a broad isthmus of keratin at 385 mm., but with significant lateral notches in the heavily keratinized shield. There are no preoculars. The posterior processes of the nasals (which segments neither touch each other nor the lip) are excluded from contact with the ocular by a wide contact zone between third supralabial and head shield. The pectoral region is wide and very short. The medial pair of shields is by far the largest. They are widest posteriorly and are joined anteriorly by a second and smaller medial pair (derivative of the first pectoral annulus) that widens anteriorly, with three to five pairs of much smaller shields clustering around the junction. One of the two of these may be replaced by a roughly parallel-sided lateral pair flanking the medial shields along their length. The lateral sulci are poorly expressed and the dorsal ones are absent. Both zones show major and crossing diagonal folding lines. Supernumerary dorsal half-annuli number 14 to 19 in the first 50 (14 to 24 in the first 100) body annuli and very few thereafter. The dorsal inter-

annular sutures cross the trunk at right angles to its long axis. There are no precloacal pores. Autotomy occurs at the third to fourth caudal annulus.

Description. This is a relatively stout, small to medium-sized species of *Monopeltis* with the available specimens ranging from 203 to 385 mm. in snout-vent length (fig. 20). Most specimens are badly faded, but parts of USNM 20037 still show definite speckling of melanophores in a middorsal band that starts in the anterior third of the body, extends onto the base of the tail and descends to the level of the lateral sulcus.

The dorsal surface of the head is covered by two heavily keratinized azygous head shields in smaller specimens (less than 208 mm. snout-vent). The medial third of the intermediate raphe has fused in larger specimens (greater than 350 mm.), with a heavy build-up of keratin on the anteromedial portion of the anterior and the center of the posterior shield. The medial line of the anterior shield is straight and that of the posterior shield convex; laterally there is a marked convexity anterior to the ocular on each side, providing an anterior exposure for the eye.

The eye is clearly visible as a dark spot beneath the quadrilateral ocular in the smaller specimens; only in the largest one is it obscured. The ocular is in contact anteriorly with the first azygous shield, dorsally with the second, ventrally with the third supralabial, and posteriorly with the second of five or six parietal segments. These segments link the third and fourth supralabials on each side and separate the posterior azygous head shields from the segments of the first body annulus.

The crescent-shaped nostrils are inserted in medium-sized nasal segments that are well separated from the oculars, the lip, and each other. There are three or four supralabials, the first very small, the second narrow but elongate, and the third (and sometimes fourth) narrow and variably spaced. (The last two, jointly with the most lateral parietal, occupy the space taken by the enlarged third supralabial in other spade-snouted species.)

The lower jaw is covered by the squarish mental with flaring anterior edges and the anteriorly concave posterior edge, the first, second, and enormous third infralabials, and the large, heart-shaped postmental (genial) which is in broad con-
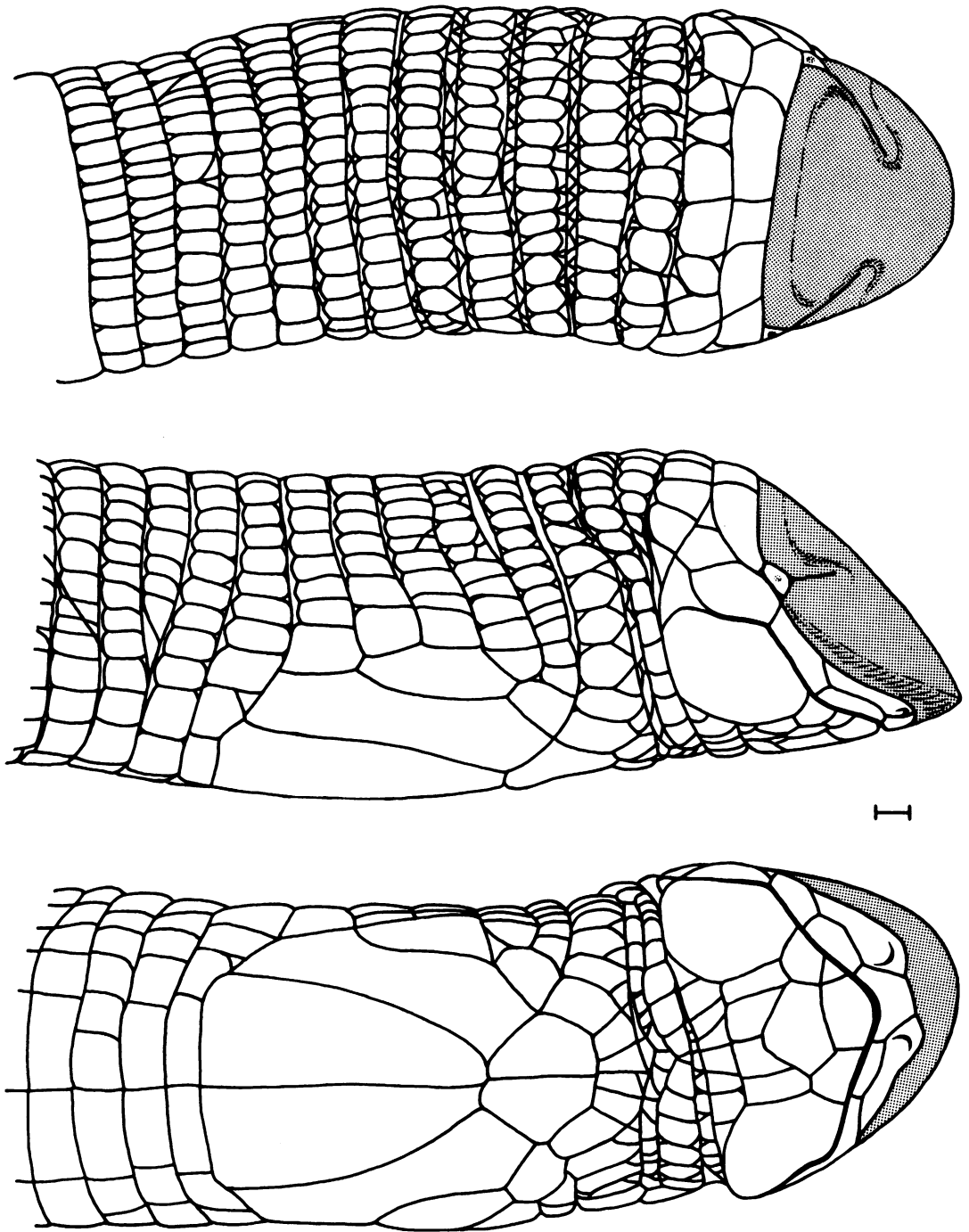
FIG. 103. *Monopeltis luandae*. Pattern of head scalation. Dorsal, lateral, and ventral views of head and pectoral region of the holotype AMNH 111338 from the road to the Quanza mouth, Luanda, Angola. The line equals 1 mm. to scale. (After Gans, 1976.)
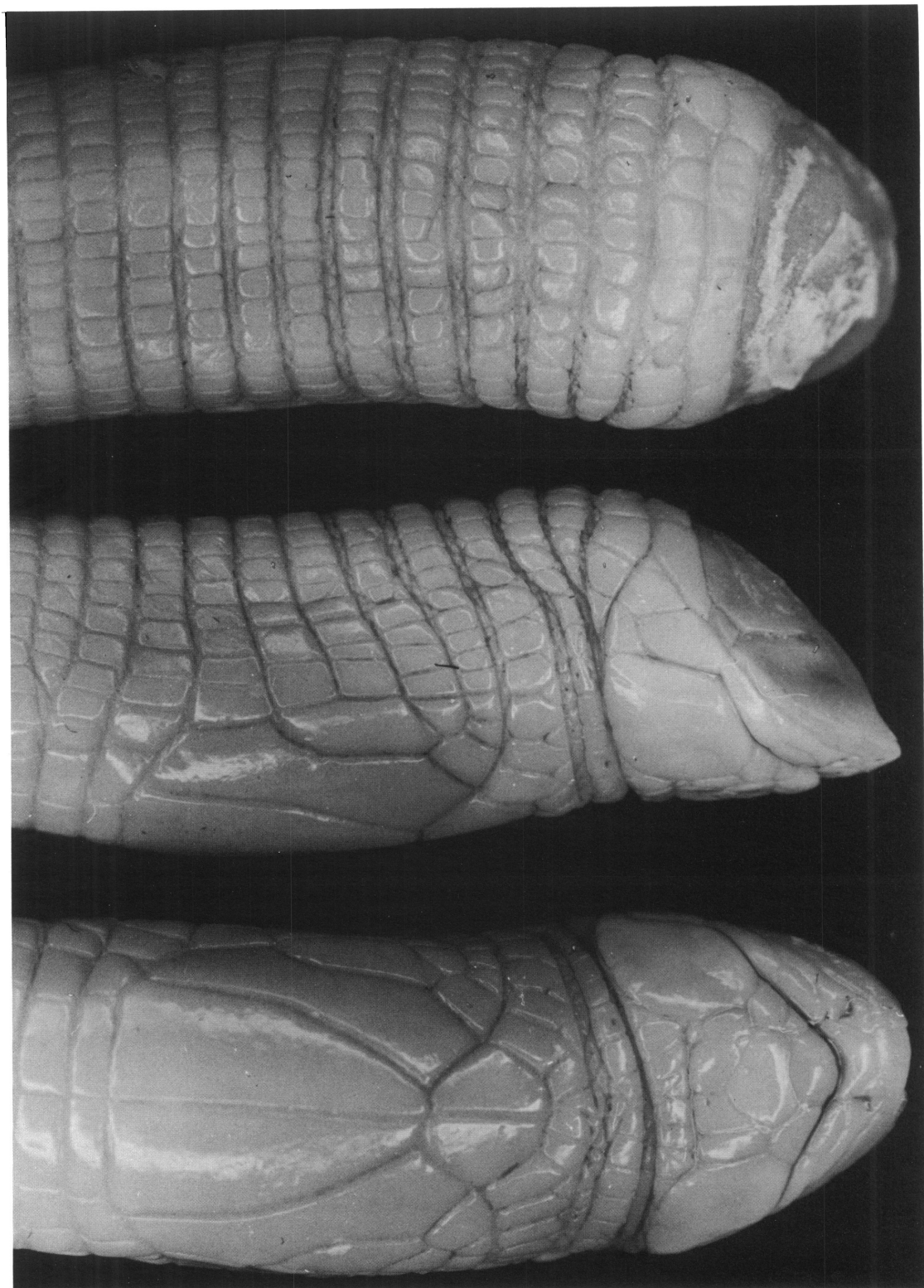
FIG. 104. *Monopeltis luandae.* Dorsal, lateral, and ventral views of the head of the holotype AMNH 111338 from the road to the Quanza mouth, Luanda, Angola, to show anterior segmentation. Part of the keratinous edge is damaged.

tact with the first and second infralabials. The rectangular lateral segments of the first post-genial row contact the second infralabials and postmental; the subquadrangular medial first postgenials have broad contact behind the post-mental. A row of five to eight smaller second postgenials follows behind these and the third infralabials just anterior to the deep gular fold.

The modified pectoral region extends to the ninth body annulus. The pectoral arrangement involves wedge-shaped, rather than parallel shields. Generally there is a medial pair, much the widest posteriorly, flanked by one or two often shorter sets of enlarged shields on each side. The lateral ones tend to be short and may be broken into one or three separate elements. The set coreesponds to four or five body annuli, whereas the one or two more anterior annuli are much widened medially and definitely involved in the formation of the pectoral zone. A pair of medial derivatives of these anterior annuli forms an anterior prolongation of the pectoral shield pattern.

There are 223 to 227 body annuli from the posterior edge of the last infralabial up to (but not including) the cloacal shields. Those corre-sponding to the gular region generally have the dorsal interannular raphes widened and filled with tiny segments, equivalent to but less pro-nounced than those filling the deep gular folds. There are 14 to 19 supernumerary dorsal half-annuli in the first 50 (14 to 24 in the first 100) body annuli and very few thereafter. A midbody annulus has 29 to 36 (generally 30 or 32) dorsal plus 14 to 20 ventral segments. The middorsal segments are approximately three times as long as wide and the midventral segments one and one-half times as wide as long. The number of dorsal segments is consistently greater than the number of ventrals.

There are generally four lateral annuli, the first and/or second in contact with the four seg-ments on the enlarged precloacal shield. There are no precloacal pores.

The medium-sized tail is pointed in juveniles and rounded in the larger specimens. There are 15 or 16 caudal annuli, with an autotomy con-striction at the third or fourth of these after which the tail tends to be slightly swollen, some-times increased in dorsoventral dimension and laterally compressed up to the smoothly rounded tip. The shallowly inscribed remnants of annular raphes give this a concentric pattern in distal view. The larger specimens show major damage to parts of the body and tail, with the partial healing covered by geometrically irregular seg-mentation.

The lateral sulci are very narrow and poorly defined; they involve some irregularity and are only one-half as wide as the adjacent segments. The dorsal surface is crossed by many diagonal folding lines, but lacks a dorsal sulcus. The ven-tral sulcus is only indicated by alignment of intersegmental sutures.

Locality Records. ANGOLA: Luanda: CG 5219 (near airport after rain); AMNH 111338 (road to Quanza mouth); USNM 20037-20038. (Type series, Gans, 1976).
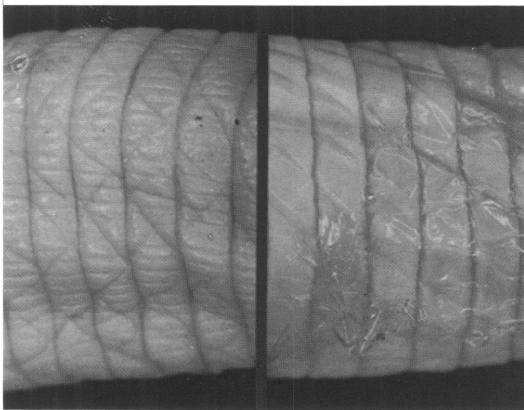

FIG. 105. *Monopeltis luandae.* Left, lateral view, and right, ventral view at midbody to show segment arrangement and diagonal folds across the dorsal surface of the holotype AMNH 111338 from the road to the Quanza mouth, Luanda, Angola.

Dalophia Gray

Dalophia Gray, 1865, p. 454. Type species: *Dalophia welwitschii*, by monotypy.
Tomuropeltis Laurent, 1947, p. 58. Type species: *M. giganteus* Peracca, by original designation.

Diagnosis (Modified after Vanzolini, 1951). Very similar to *Monopeltis*, but nasal shields almost always separated by rostral segment, no
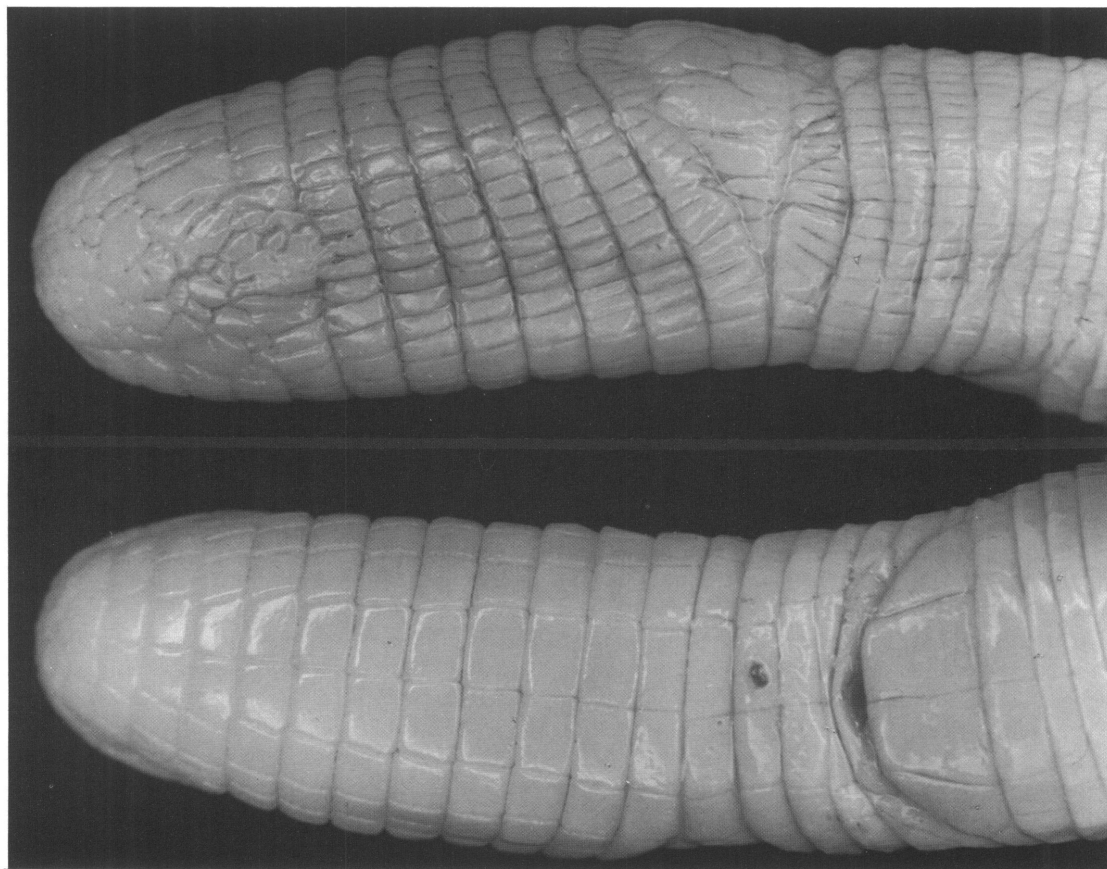
FIG. 106. *Monopeltis luandae*. Top, lateral view and bottom, ventral view of tail of holotype AMNH 111338 from the road to Quanza mouth, Luanda, Angola. Note the severe scarring and the tissue healing of this partially autotomized tail.

precloacal pores, generally only a single cephalic shield, always a modified pectoral region, and tip of the tail always squarely truncate and produced into a flattened callous pad. Table 2 presents meristic differences for all but the northernmost populations.

KEY TO THE SPECIES OF THE GENUS *DALOPHIA*

1a. Azygous head shields discrete or fused; a preocular present; adults exceed 520 mm. in snout-vent length. . . . . *D. gigantea*
1b. Azygous head shields fused; no preocular; maximum snout-vent length 520 mm. 2

2a. A constricted autotomy annulus (after the fourth to seventh caudal annulus). . . . 5
2b. No constricted autotomy annulus. 3
3a. Caudal annuli 17-33. 4
3b. Caudal annuli 36-46. . . . . . . *D. longicauda*
4a. Caudal annuli 19-33; dorsal segments in a midbody annulus 18-24; dorsum lightly speckled . . . . *D. pistillum*
4b. Caudal annuli 17; dorsal segments in a midbody annulus 16; dorsum unpigmented . . . . *D. luluae*
5a. Body annuli 264-270; caudal annuli 19 . . . . *D. welwitschii*
5b. Body annuli 302-344; caudal annuli 20-45 6
6a. Caudal annuli 20-27. . . . . . . *D. angolensis*
6b. Caudal annuli 30-45. . . . . . *D. ellenbergeri*

Dalophia welwitschii Gray
Figures 107-111

Dalophia welwitschii Gray, 1865, p. 455. *Terra typica*: "Angola; Pungo Andongo." Syntypes: BM 64.7.13.34:RR1946.8.20.89-64.7.13.35:-RR1946.8.20.90.

Diagnosis. A medium-sized (268 to 293 mm. snout-vent length) species of *Dalophia* lacking pigmentation and having 264 to 270 body and 19 caudal annuli, 17 to 20 dorsal, and 14 to 17 ventral segments to a midbody annulus and four first plus eight or nine second postgenials. The head shields are broadly fused and only lateral blind sutures remain. The types lack preoculars, but USNM 26387 retains traces thereof, and the nasals (which are not in contact medially) are excluded from contact with the ocular regions by the third supralabial, which broadly touches the head shield. The two lateral pairs of the six pectoral shields are irregularly divided and the anterior zone of the medial pairs extends into two annular rows. Lateral sulci are deeply incised and the middorsal sulcus is mainly shown as a zigzag alignment of intersegmental sutures, the dorsal surface of the trunk being crisscrossed by deep diagonal folds. The fifth or sixth caudal annulus bears the autotomy constriction. There are neither fusions nor herringbone patterns along the segments of the dorsal surface of the tail.

Description. This is a small to medium-sized species of *Dalophia* with the available specimens ranging from 268 to 293 mm. snout-vent length (fig. 35). The specimens are faded or the species lacks pigmentation.

The azygous head shield is single (more or less pointed anteriorly), and oval; blind, anteriorly directed sutures enter from the anteromedial tip of the ocular and extend for a sixth (to a third) of the width of the shield.

(One specimen shows a preocular, the keratinization of the anterior edge of which is partially fused.) The eye is faintly visible as a dark spot deep beneath the tiny subpentagonal ocular which is in contact dorsally with the posterior portion of the azygous shield, anteriorly with the anterior portion thereof (or the preocular), ventrally with the third infralabial,

and posteriorly with the first of four parietals (the medial pair the longest) that connect the third supralabials and separate the head shields from the first body annulus.

The crescent-shaped nostrils insert into elongate nasals that send long posterior processes that do not reach the oculars (or preoculars), the lip, or each other. There are three supralabials, the first the smallest, the second by far the longest, and the third the tallest.

The lower jaw is covered by a wide, rectangular mental with flaring anterior sides and a complexly curved posterior contact with the postmental, the first, second, and enormous third infralabials, and the large, heart-shaped postmental (genial). The two rectangular lateral segments of the first postgenial row may or may not contact the postmental; the triangular medial first postgenials contact each other behind the posterior apex of the postmental. There are eight to nine second postgenials anterior to the deep gular folds.

The modified pectoral region extends to the eighth through the tenth body annulus. There are six elongate and subparallel pectoral shields, the medial pair widest posteriorly (but almost perfectly parallel), and the lateral pairs showing irregular fusions. The enlarged shields correspond to five or six dorsal half-annuli. The next anterior annulus is widened medially and involved in the pectoral shield and produces two large median segments that interdigitate between the first and second shields on each side. The pectoral region projects posteriorly in a semicircle that distorts the following body annuli.

There are 264 to 270 body annuli from the posterior edge of the third infralabial up to (but not including) the precloacal shields. One or two supernumerary dorsal half-annuli occur in the first 50 body annuli, six or seven in the second 50, and none thereafter. A midbody annulus has 17 to 20 dorsal plus 14 to 17 ventral segments. The middorsal segments are approximately two to two and one-half times as long as wide and the midventral segments one and one-half times as wide as long. There is a faint tendency for the sutures between the dorsal segments to angle into posteriorly directed chevrons.

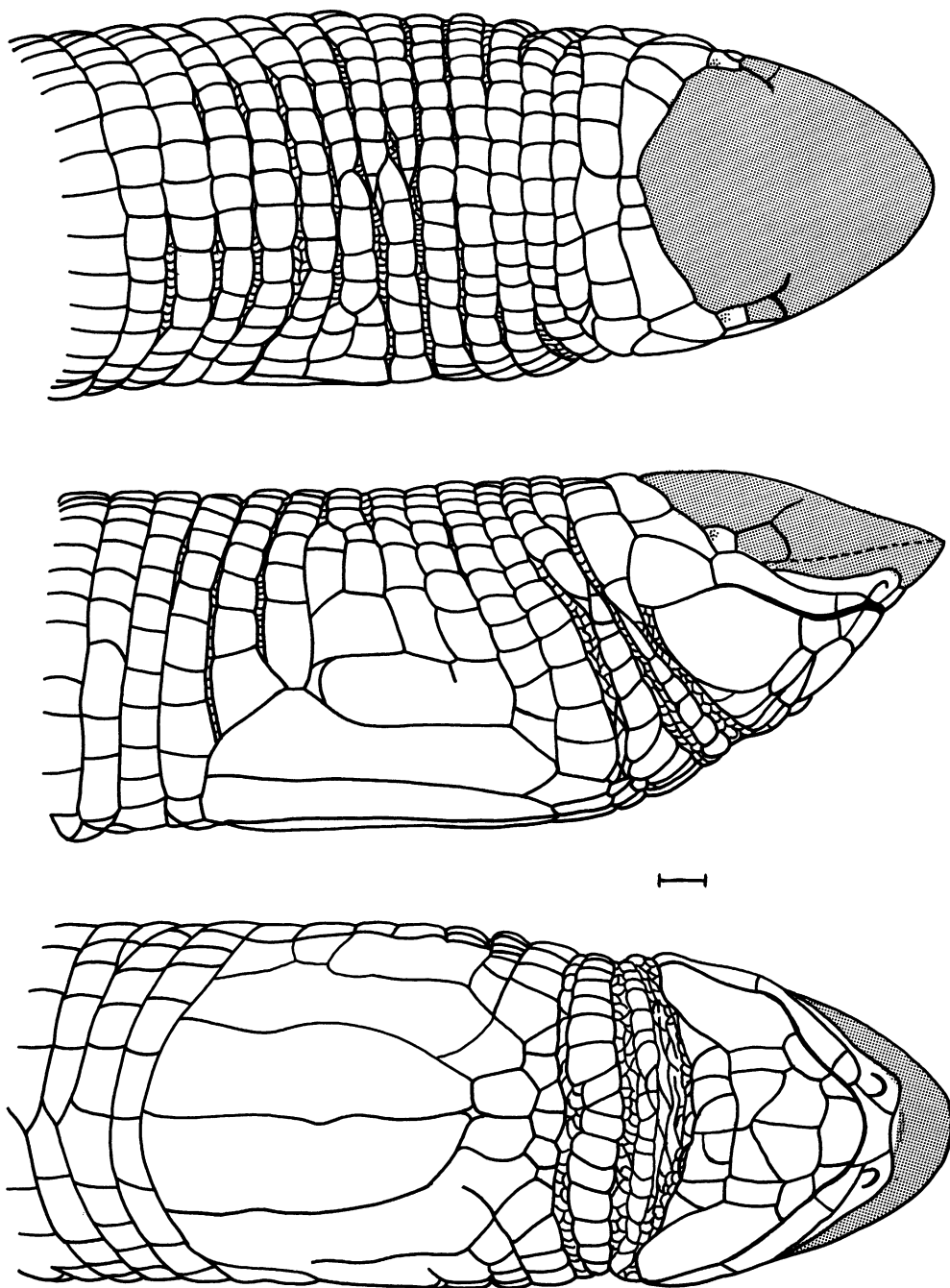There are three to five lateral annuli, two of

FIG. 107. *Dalophia welwitschii.* Pattern of head scalation. Dorsal, lateral, and ventral views of head and pectoral region of USNM 28397 from 300 miles inland from Benguella, Angola. The line equals 1 mm. to scale.

which contact the outer of the six precloacal shields, of which the median pair is widest (and the intersegmental sutures angle posteromedially, rather than paralleling the long axis). There are no precloacal pores.

The moderate tail appears slightly compressed laterally and down-curved. Its distal portion is taller than wide and its height drops abruptly over the last four of the 19 caudal annuli. The tail terminates in a projecting and unsegmented, vertically oval callous pad with the projection slightly longer than a preceding annu-
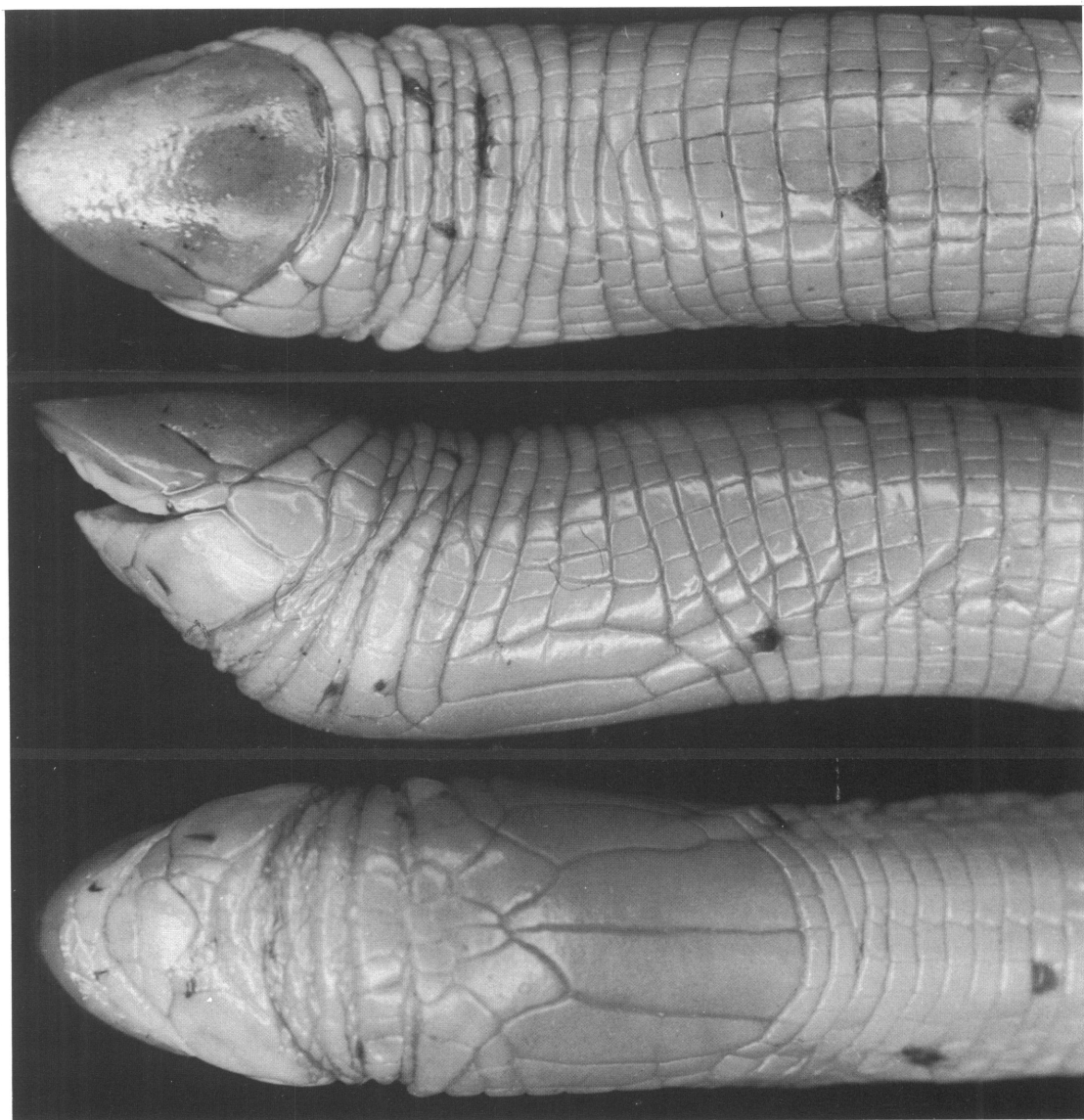
FIG. 108. *Dalophia welwitschii.* Dorsal, lateral, and ventral views of head of syntype BM RR1946.8.20.90 from Pungo Andongo, Angola. Note the partially divided head shields, the advanced pectoral pattern and the point contact of the nasals.
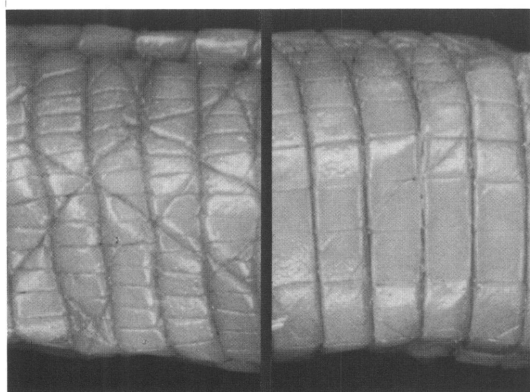
FIG. 109. *Dalophia welwitschii*. Left, dorsal view, and right, ventral view at midbody to show segment arrangement and diagonal folding lines of the syntype BM RR1946.8.20.90 from Pungo Andongo, Angola.

lus. In dorsal view the interannular sutures cross the tail transversely without herringbone effect. The fifth or sixth caudal annulus bears the autotomy constriction.

The lateral sulci are deep and distinct and as wide as an adjacent segment. There is some trace of a middorsal sulcus as a zigzag alignment of intersegmental sutures and irregularities; the dorsal surface of the trunk is crisscrossed by an unusual density of deep, diagonal folding lines. The ventral sulcus is indicated only by alignment of intersegmental raphes.

Comments. There is some uncertainty about the assignment of these three specimens to the same taxon. USNM 26387 seems to be slightly larger but also has a more pointed azygous head shield. It also has partially subdivided preoculars (and other minor differences shown in parentheses above). However, it agrees with the types

FIG. 110. *Dalophia welwitschii*. Top, lateral view and bottom, ventral view of the tail of the syntype BM RR1946.8.20.90, from Pungo Andongo, Angola.
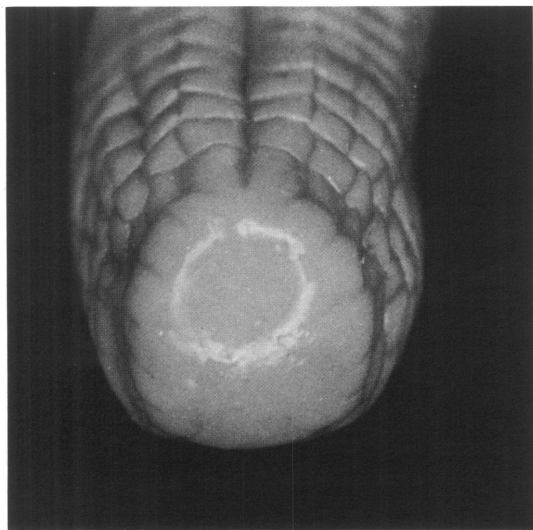
FIG. 111. *Dalophia welwitschii.* View of distal tip of tail showing flattened terminal shield of the syntype BM RR1946.8.20.90 from Pungo Andongo, Angola.

in the absence of contact between the nasals, the general numbers of segments, the pectoral arrangement and the sulcal pattern. Perhaps this species is polytypic.

Locality Records. ANGOLA: Pungo Andongo: BM 64.7.13.34:RR1946.8.20.89-64.7.13.35:-RR1946.8.20.90 (Syntypes *D. welwitschii* Gray, 1865, 1872, 1873; Boulenger, 1885; Loveridge, 1941; Strauch, 1881). "300 miles inland from Benguella": USNM 26387.

Dalophia angolensis Gans
Figures 112-115

Dalophia angolensis Gans, 1975, p. 6. *Terra typica*: "Calombe, 7 km. "west" of Vila Luso, on Vila Luso-Moxico road, Angola." Holotype: CZL 167. Paratypes: AMNH 111339; CZL 50, 204, 265, 292-300, 317-318, 387-388, 399-400.

Diagnosis. A slender, medium-sized (290 to 362 mm. snout-vent length) species of *Dalophia* that lacks pigmentation and has 302 to 324 body and 20 to 27 caudal annuli, 16 to 24 (generally 18) dorsal and 12 to 18 (generally 14) ventral segments to a midbody annulus and four or five first plus eight to 11 (generally eight or nine)

second postgenials. The head shields are broadly fused and only the lateral blind sutures remain. There are no preoculars and the nasals (in narrow contact medially) almost always extend long wings laterally to touch the oculars. There are six elongate pectoral shields, the lateral ones often asymmetrically subdivided and the two medial pairs generally extending anteriorly into one or two annular rows. Lateral sulci are clearly expressed, but the dorsal sulcus is only indicated by intersegmental alignment. The sixth or seventh caudal annulus bears the well-defined autotomy constriction. There are few supernumerary dorsal half-annuli, but the second 50 body annuli tend to show irregular dorso-ventral alignments. The intersegmental sutures of the first 100 or so body annuli form anteriorly acute angles with the midline. The middorsal caudal segments posterior to the autotomy constriction are at least twice as wide as those near the base of the tail; the caudal interannular sutures form an anteriorly acute angle on the middorsal surface.

Description. This is a medium-sized slender species of *Dalophia* with the available specimens ranging from 131 to 362 mm. snout-vent length (fig. 35). None of the specimens shows pigmentation.

The azygous head shield is single, more or less pointed anteriorly, oval and relatively slender. The oculars are only partially inserted into shallow notches along its sides. A short, blind suture proceeds anteromedially for one-fifth of the shield width from each notch. The preocular region is slightly concave, however the dorsal surface of the head is faintly convex particularly along the medial line. The shield shows a high dome in transverse section.

The eye is clearly visible beneath the medium-sized rectangular ocular which is in contact dorsally and anteriorly with the azygous head shield, anteroventrally with the prolongation of the nasal (excluded in NMSR 2826), ventrally with the second and generally the anterior tip of the third supralabial and posteriorly with the first of the four parietals (the medial pair the longest) that connect dorsally between the third supralabials and separate the head shields from the first body annulus.

The crescent-shaped nostrils are inserted into elongate nasals which send long posterior processes to contact the ocular (except in NMSR
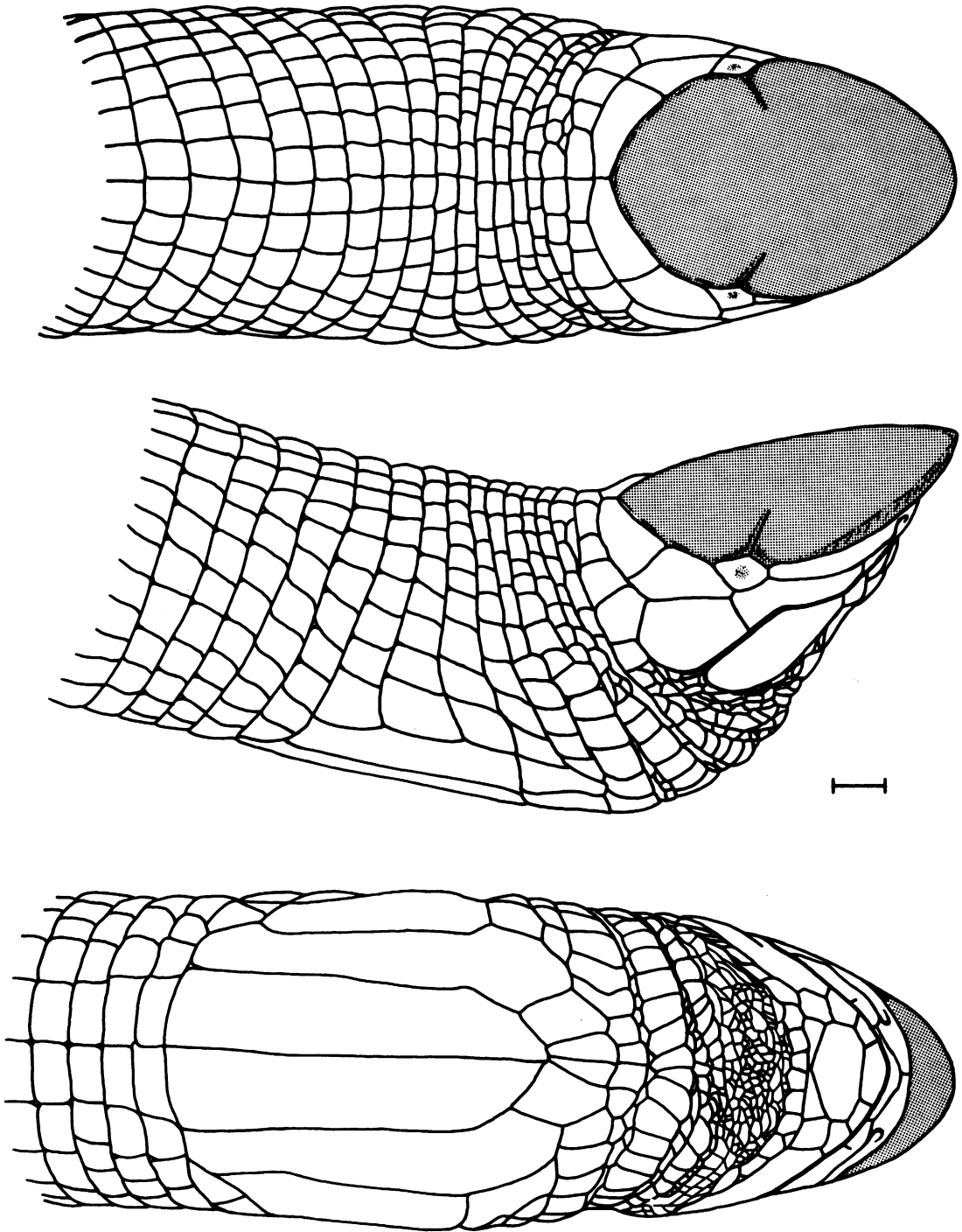
FIG. 112. *Dalophia angolensis.* Dorsal (top), lateral (middle), and ventral (bottom) views of anterior portion of paratype CZL 297 from Calombe, Angola. The line equals 1 mm. to scale. (After Gans, 1976.)

FIG. 113. *Dalophia angolensis*. Dorsal, lateral, and ventral views of the head of the paratype CZL 297 from Calombe, Angola, to show anterior segmentation and keratinization.

2826) and are generally in narrow medial contact with each other, but not with the lip. There are three supralabials, the second the longest, the third the largest and tallest.

The lower jaw is covered by a broadly rectangular mental with markedly flaring anterior edges and anteriorly concave suture with the postmental, the small first, second, and enormous third infralabials, and the squat, pentagonal postmental (genial). The rectangular lateral first postgenials may or may not contact the postmental. Median to them lies a pair of subtriangular segments that either contact each other medially, or contact a tiny fifth postgenial of the first row posterior to the blunt apex of the postmental. There are six to 11 smaller second postgenials in a row that extends posterior to the medial aspects of the second infralabials as well and adjoins the deep gular fold.

The modified pectoral region extends to the tenth to twelfth (generally to the eleventh) body annulus. There are six elongate and subparallel pectoral shields, the median pair slightly wider posteriorly, the next lateral widest anteriorly and the irregular lateral pair the shortest. The last (or its fission products) correspond to three to five (six in NMSR 2826) dorsal half-annuli, and the more median pairs involve six. The ventromedian segments of the next more anterior annulus are enlarged, and the four segments flanking the midline represent a complex elongation of the median pair of pectoral shields. The prepectoral annulus is definitely involved in the pectoral region. The pectoral region projects slightly posteriorly in a semicircle that distorts the postpectoral annuli.

There are 302 to 324 body annuli from the posterior edge of the third infralabial up to, but not including, the precloacal shield. The second 50 body annuli tend to show up to five supernumerary dorsal half-annuli as well as irregular dorsoventral alignments. A midbody annulus has 16 to 24 (generally 18) dorsal and 12 to 18 (generally 14) ventral segments. The middorsal segments are approximately twice as long as wide and the midventral segments one and one-half to two times as wide as long. The number of dorsal segments is consistently greater than the number of ventral segments for any given specimen. There is a marked tendency for the sutures between the dorsal segments to angle into posteriorly directed chevrons along much of the back.

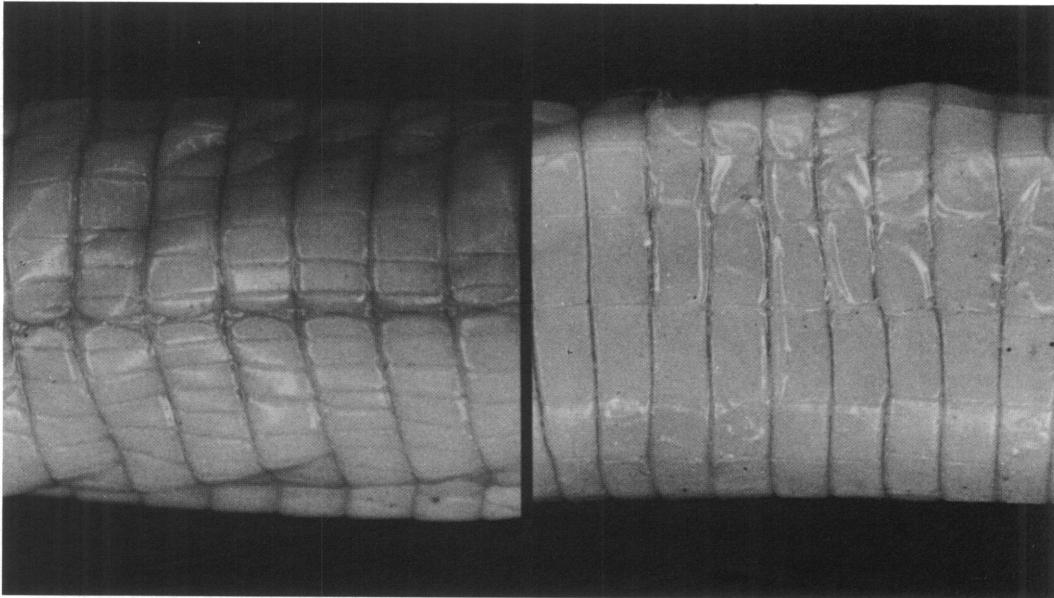There are two to six (generally four or five)

FIG. 114. *Dalophia angolensis*. Left, dorsal view, and right, ventral view at midbody of the paratype CZL 297 from Calombe, Angola.
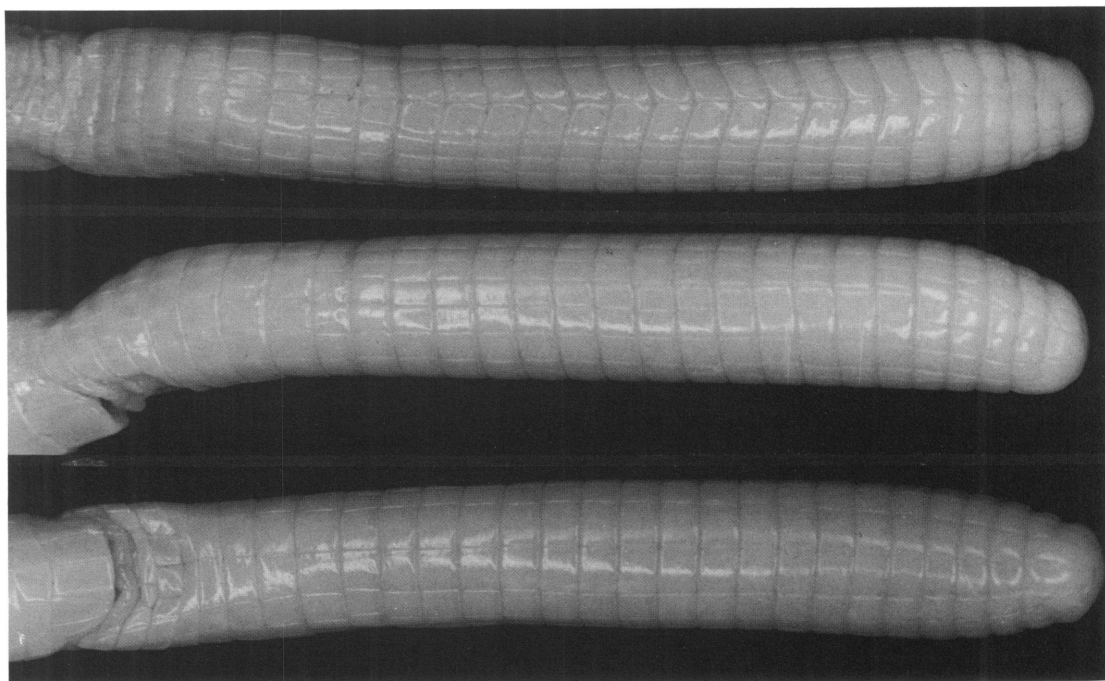
FIG. 115. *Dalophia angolensis*. Dorsal, lateral, and ventral views of cloaca and tail of the paratype CZL 297 from Calombe, Angola.

lateral annuli, the anterior one or two of which contact the small lateral segments of the six to eight (the median pair the largest) forming the precloacal shield. There are no precloacal pores.

The stout and fairly long tail appears slightly compressed laterally and downward-curved. Its distal portion is taller than wide and its height drops abruptly over the last four of 20 to 27 (generally 23 to 27) caudal annuli. The tail terminates in a projecting and unsegmented callous pad slightly longer than a preceding annulus. There is a clear autotomy constriction at the sixth or seventh caudal annulus. In dorsal view the median segments of the tail are seen to be widened posterior to the autotomy site and the interannular raphes begin to form anteriorly open Vs midway between the autotomy site and the distal tip.

The lateral sulci are strongly marked and about two-thirds as wide as an adjacent segment. The dorsal sulcus is clearly indicated by a widening of the median intersegmental raphe

and irregular alignment of left and right quarter-annuli, but is not otherwise developed nor are there diagonal folding lines. There is no ventral sulcus.

Locality Records. (All as in Gans, 1976): ANGOLA:— (Monard, 1937[1]), LCFM (unnumbered), LCFM 848.46. Alto Cuilo: MD 5344 (Laurent, 1964). Cazombo: MD 5790 (Laurent, 1964). 7 km. "west" of Vila Luso: AMNH 111339; CZL 48, 50, 167 (three specimens), 204, 265, 292-300, 317-318, 387-388, 399, 430 (all type series, Gans, 1976). Lac Calundo: MD 5601, 5705, 5744 (Laurent, 1964). Kakindo (Caquindo): LCFM (three unnumbered); NMB 13332; (Monard, 1931, 1937; Loveridge, 1941).

[1]Monard (1937) referred to seven specimens from Kakindo on the Kuvangu River and Kuvangu Mission, identified first as *M. ellenbergeri* and then as *M. granti transvaalensis*. Unfortunately he did not number his material, nor are most of the LCFM specimens numbered. Nevertheless it appears that those "no locality" specimens do derive from Kakindo (=Caquindo).

Mupanda[1]: NMB 13333 (Monard, 1937).

ZAMBIA: Zambezi River (lat. 13°01'S, long. 22°44'E): NMSR 2826.

Biological Miscellanea. Alto Cuilo specimen had been caught by a hen (Laurent, 1964).

Dalophia ellenbergeri (Angel)
Figures 116-121

Monopeltis Ellenbergeri Angel, 1920, p. 615. *Terra typica*: "Lealui Dist. (Haut Zambèze)", Zambia. Syntypes: MHNP 20.78-20.80.
Dalophia ellenbergeri, Loveridge, 1941, p. 433.

Diagnosis. A medium-sized (365 to 420 mm. snout-vent length in adults), slender species of *Dalophia* lacking dark pigmentation. The species has 312 to 344 body, three to four lateral and 35 to 43 (one specimen has 30) caudal annuli, 14 to 21 (generally 16 or 18) dorsal plus 11 to 14 (generally 12) ventral segments to a midbody annulus and two to five (generally four) first and four to nine (generally seven or eight) second postgenials. The azygous head shields are broadly fused and only lateral blind sutures occur (even in juveniles). The most heavily keratinized zone does not reach the parietal edge of the shield in juveniles. There are no preoculars. The nasals are usually in medial contact and generally fail to reach the lip; their slender posterior processes usually make contact with the oculars. There are four parietal shields. The elongate pectoral region has six slender shields, the medial ones slightly wider posteriorly and the lateral ones irregular. The four midventral segments of the precloacal annulus are enlarged and more or less wedged between the medial and adjoining pairs of pectorals. Lateral sulci are clearly expressed, but the middorsal sulcus is shown by aligned intersegmental sutures or a zigzag pattern caused by nonalignment of dorsal quarter-annuli. Additions or subtractions of dorsal half-annuli are few, but occur primarily in the second and third 50 body annuli. The species has but traces of herringbone pattern of the dorsal interannular sutures of the

trunk. There is a well-marked caudal autotomy site of the sixth to eighth (generally seventh or eighth) caudal annulus. The middorsal segments of the tail may be partially or completely fused across the midline. The interannular sutures here form an anteriorly acute set of angles with the median (their points may be rounded). Each leg of the chevron is as wide as three or four more anterior segments.

Description. This is a medium-sized but slender species of *Dalophia* with the available specimens ranging from 115 to 420 mm. snout-vent length (fig. 35). All specimens are unpigmented.

The azygous large head shields are always fused to form an oval shield, pointed anteriorly, with lateral blind sutures which are retained throughout life. The dorsal surface of the head is convex in profile.

The eye is clearly visible as a dark spot beneath the squarish ocular, which is in contact with the nasal anteriorly and the parietals posteriorly. There are no preoculars or postoculars. Two pairs of parietal shields separate the azygous head shield from the first body annulus; the median pair is the widest, but the lateral pair may extend anteriorly to contact the second supralabial below the ocular.

The nostrils are crescent-shaped and are inserted into elongate nasal scales which usually make contact with the oculars. They usually fail to reach the lip and are usually in point contact with, or narrowly separated from, each other above the triangular rostral. There are three supralabials, the second the longest.

The lower jaw is formed by a pentagonal mental, the first, second, and enormous third infralabials, and a large heart-shaped postmental (genial), which is longitudinally divided in UM 7913. Posterior to the postmental are two to five (usually four) first postgenials followed by four to nine (usually seven or eight) smaller second postgenials.

The modified pectoral region extends to the ninth through the twelfth dorsal annulus; there are six elongate pectorals, the medial ones slightly wider posteriorly. The four midventral segments of the prepectoral annulus are enlarged and the outer pair of these are wedged between first and second pairs of pectorals. The lateral

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[1]This locality was not mentioned for this form (Monard, 1937). It may represent a cataloguing error as does NMB 13330, the paratype of *Amphisbaena ambuellensis* Monard, 1931, which is entered as "Kuvangu," from which locality Monard did not have specimens.
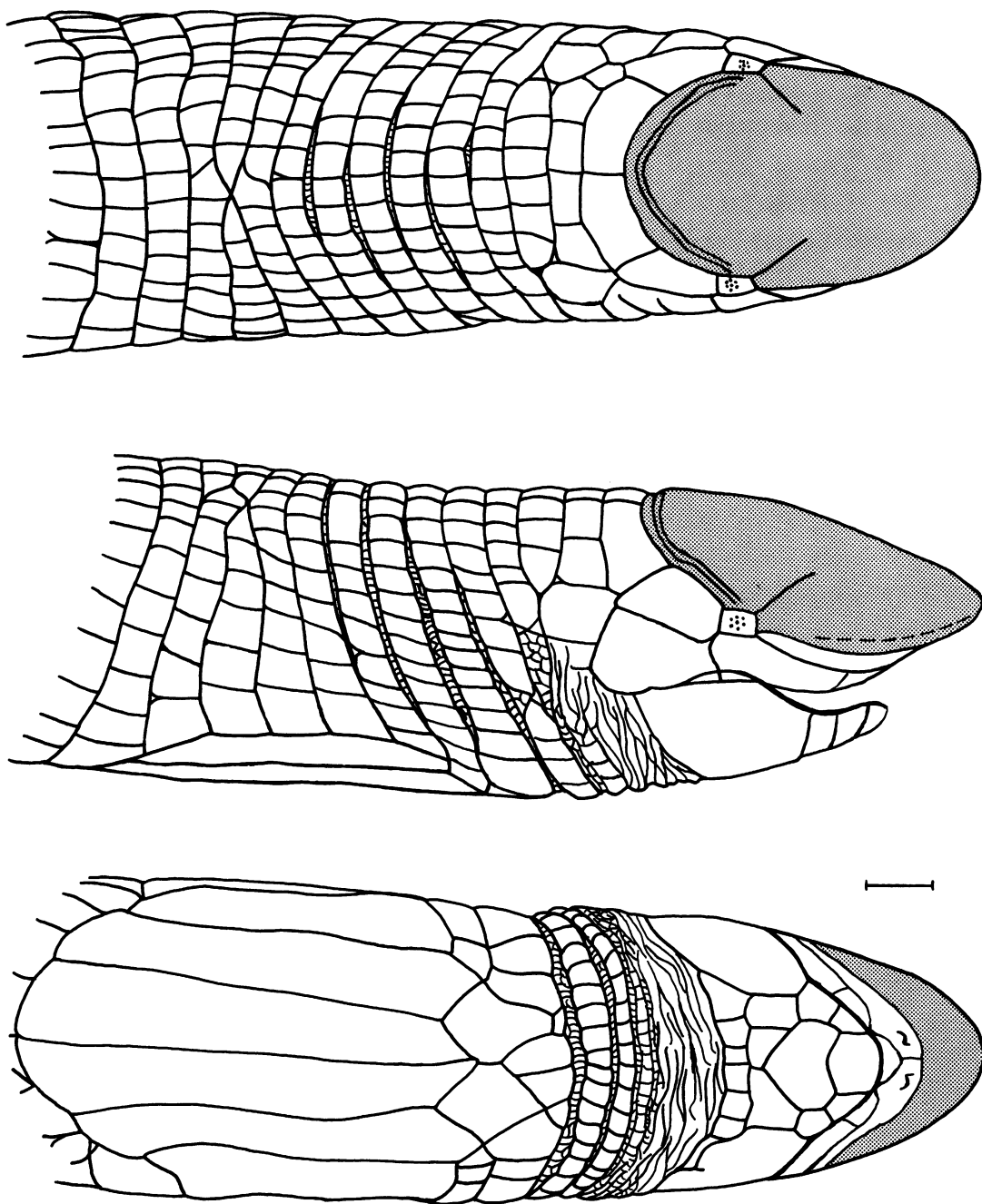
FIG. 116. *Dalophia ellenbergeri.* Pattern of head scalation. Dorsal, lateral, and ventral views of head and pectoral region of UM 6903 from Kalabo, Zambia. The line equals 1 mm. to scale.

pectorals are much shorter than the medial ones, which extend posteriorly in a semicircular bulge that distorts the postpectoral annulus strongly and the succeeding few to a lesser extent.

There are 312 to 344 body annuli from the posterior edge of the third infralabial up to (but not including) the precloacal shields. A maximum of five supernumerary dorsal half-annuli

FIG. 117. *Dalophia ellenbergeri.* Dorsal (top), lateral (middle), and ventral (bottom) views of the anterior region of UM 4828 from Kalabo, Zambia. The line equals 1 mm. to scale.
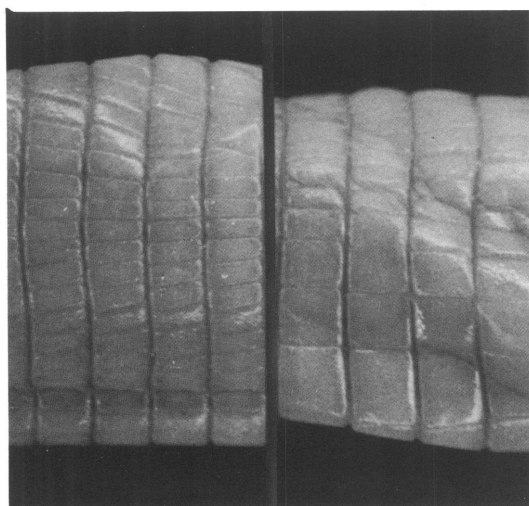
FIG. 118. *Dalophia ellenbergeri*. Left, dorsal view, and right, ventral view at midbody of UM 4828 from Kalabo, Zambia.

may be present, usually in the second 50 body annuli. Other dorsal half-annuli may drop out, especially in the third 50 body annuli. A midbody annulus has 14 to 21 dorsal plus 11 to 14 (usually 12) ventral segments. The middorsal segments are approximately one and a-half to three times as long as wide, and the midventral segments are approximately two to four times as wide as long. The sutures between dorsal segments are often angled to form a pattern of posteriorly directed chevrons.

There are three to four (rarely two asymmetrically) lateral annuli and six precloacal segments, the median pair largest. There are no precloacal pores.

The elongate tail (fig. 36) appears dorsoventrally flattened in cross section and curves ventrally to an unsegmented truncated and callous terminal pad. On the dorsal surface of the tail posterior to the autotomy annulus the middorsal segments are nearly twice as wide as long; some may be partially or completely fused and are angled to form a series of posteriorly directed chevrons. There are 35 to 43 (30 in FMNH 142694) caudal annuli, with the seventh or eighth (sixth in FMNH 142685) a distinctly narrowed autotomy annulus. Six specimens had autotomized tails (which show faint irregular seg-

mentation of the stump) and several others show partial breaks at this point.

The lateral sulci are distinct and a dorsal sulcus may be indicated either by an alignment of the vertebral sutures or a zigzag pattern caused by nonalignment of dorsal quarter-annuli, so that they alternate on either side of the vertebral line; a similar situation may develop along the midventral line. There are no diagonal folding lines on the body.

Locality Records. ZAMBIA: Balovale: BM 1937.6.2.1. Kalabo: AMNH 113080-113082; BM 1963.139; CG 4823, 4826; FMNH 142682-142683, 142685-142694, 142746; TM 33888-33890, 38894; UM 4827-4828, 6744-6745, 6902-6903, 7253-7254, 7911-7914, 10083, 10166 (Broadley, 1971a). Lukona Mission: FMNH 134554-134556. Lealui District: MNHP 20.78-20.80 (Syntypes of *Monopeltis ellenbergeri* Angel, 1920; Loveridge, 1941).

Biological Miscellanea. There is a single maxillary tooth on each side (Angel, 1920). UM 10166 was taken from the stomach of a beaked snake *Rhamphiophis acutus jappi* (Broadley, 1971c).

Dalophia gigantea (Peracca)
Figures 122-125

Monopeltis giganteus Peracca, 1903, p. 1. *Terra typica*: "Congo." Syntypes: IMZUT 2844; MSNG CE 36071.
Monopeltis truncata Witte, 1922, p. 68. *Terra typica*: "Kwango," Zaire. Amplified to:
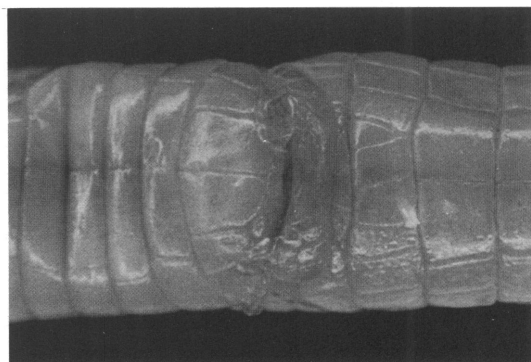

FIG. 119. *Dalophia ellenbergeri*. Ventral views of cloaca of UM 4828 from Kalabo, Zambia.
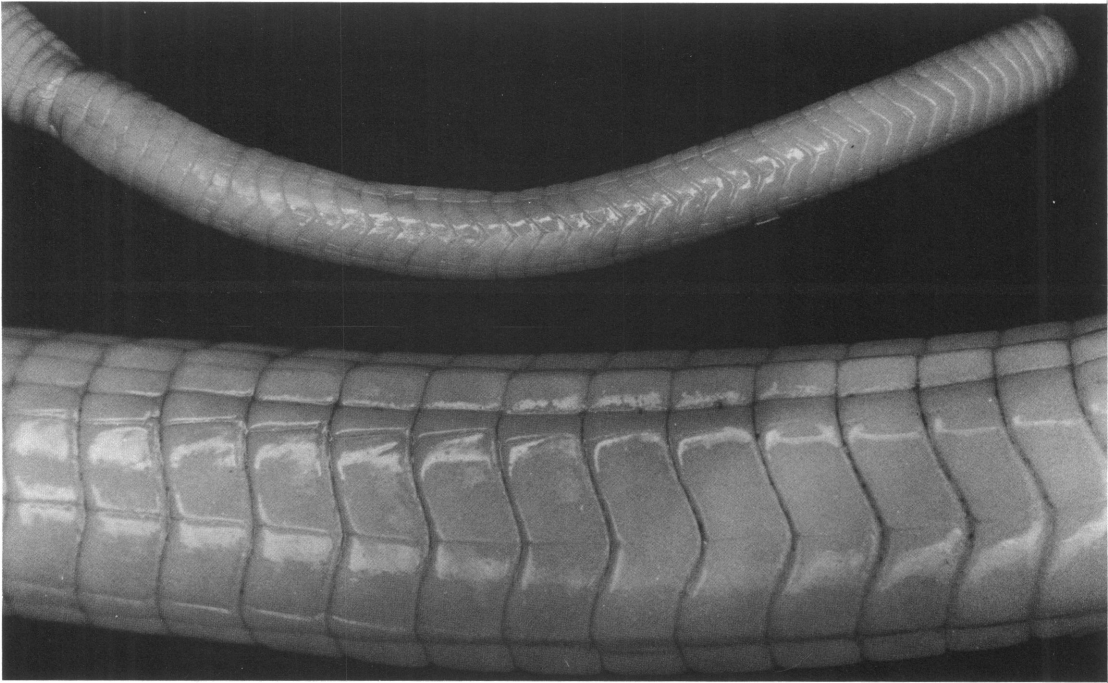
FIG. 120. *Dalophia ellenbergeri.* Top, dorsal view of entire tail of FMNH 134555 from Lukona Mission, Zambia and bottom, detail of medial segments.
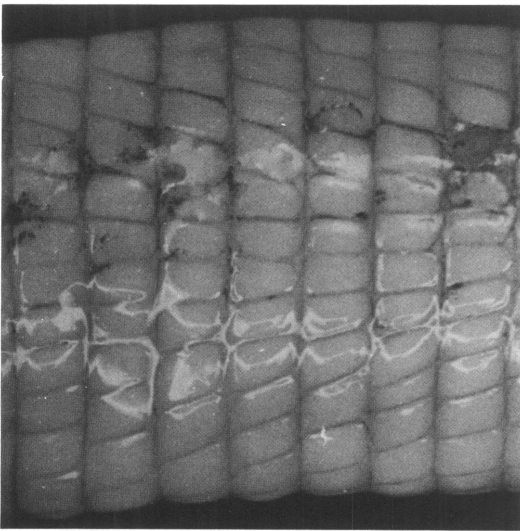

FIG. 121. *Dalophia ellenbergeri.* Dorsal view of nuchal region of FMNH 142694 from Kalabo, Zambia. Note that the dorsolateral segments form parallelograms rather than rectangles, whereas the dorsal sulcus is indicated only by alignment of sutures.

"Popokabaka" Witte, 1927. Holotype: RGMC 32.

Dalophia gigantea: Loveridge, 1941, p. 429. Emendation.

Diagnosis. A very large (582 to 705 mm. snout-vent length) species of *Dalophia* lacking pigmentation and having 316 to 321 body annuli, 21 to 23 caudal annuli, 19 to 21 (generally 20) dorsal and 17 to 19 (generally 18) ventral segments to a midbody annulus and four first plus eight to 10 second postgenials. The two very large, discrete, and azygous head shields show narrow medial fusion of their keratinous cover in one specimen (RGMC 32). The preoculars are well defined and may be but partially separated from the anterior shield (medially in broad contact). The nasals (or their postnasals) contact the preoculars. There are six pectoral shields, with the second on each side not reaching the posterior edge of the zone, and the two medial pairs extending anteriorly into two annular rows. Lateral and middorsal sulci are deeply expressed. There is a tendency to extra dorsal half-annuli in the second 50 body annuli.
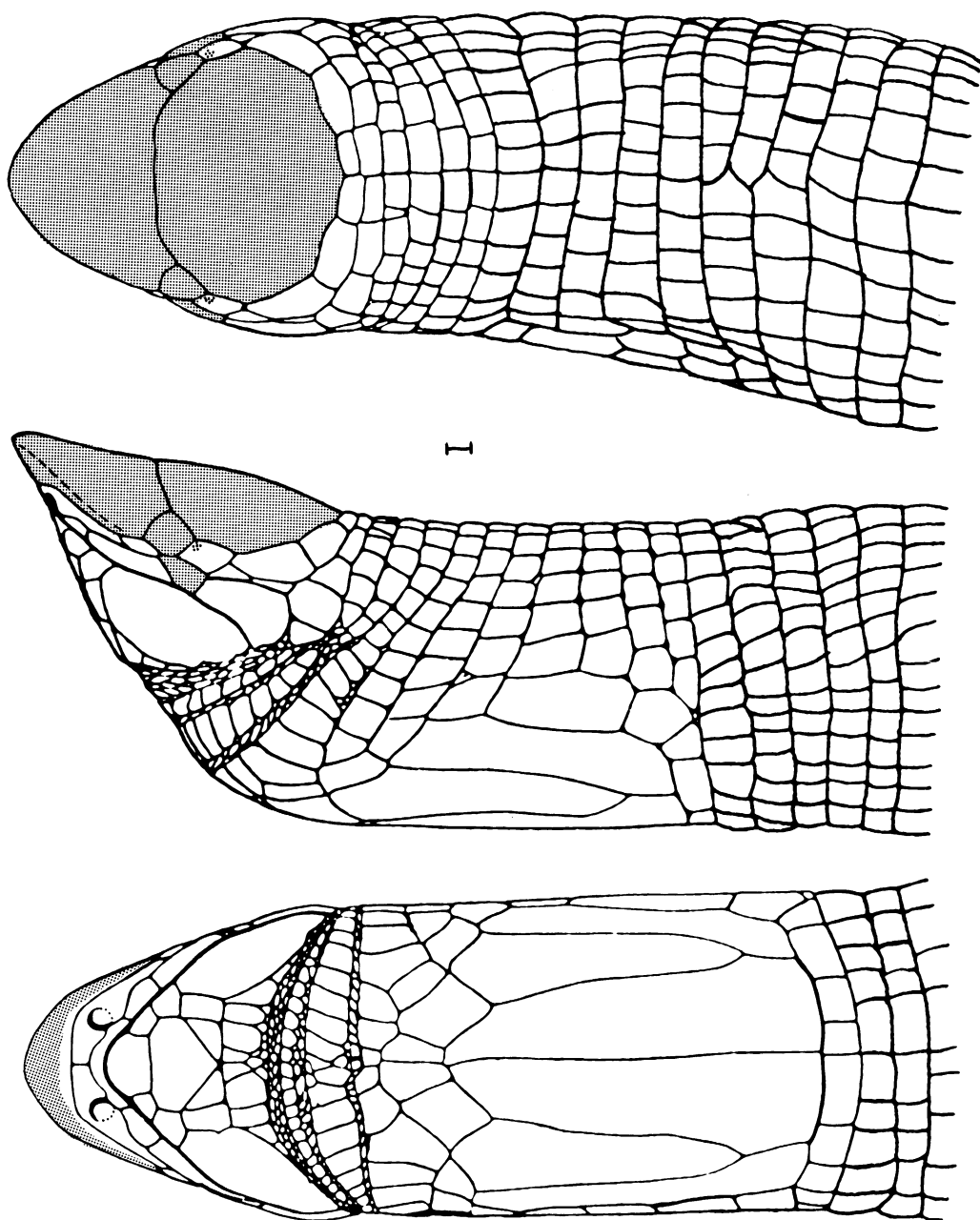
FIG. 122. *Dalophia gigantea*. Pattern of head scalation. Dorsal, lateral, and ventral views of RGMC 4574, from Kwango, Zaire. The line equals 1 mm. to scale. (After Witte, 1954).

The species lacks caudal autotomy and shows no fusion or herringbone effect on the dorsal surface of trunk or tail.

Description. This is the largest species of *Dalophia* with the available specimens ranging from 582 to 705 mm. snout-vent length (fig. 35). All specimens lack pigmentation.

The dorsal surface of the head is divided into

two azygous shields although the small RGMC 32 shows the medial half of the division fused and overlain by a thick sheet of keratin. The largest specimen, RGMC 4573, also has a slight asymmetrical zone of fusion of this line. The midline is slightly concave over the anterior and convex over the posterior shield, with the convexity much greater transversely. Both azygous shields, the preocular, as well as the posterior edge of (nasal or postnasal) and/or the posterior edge of the second supralabial may show local keratinization to different degrees. In
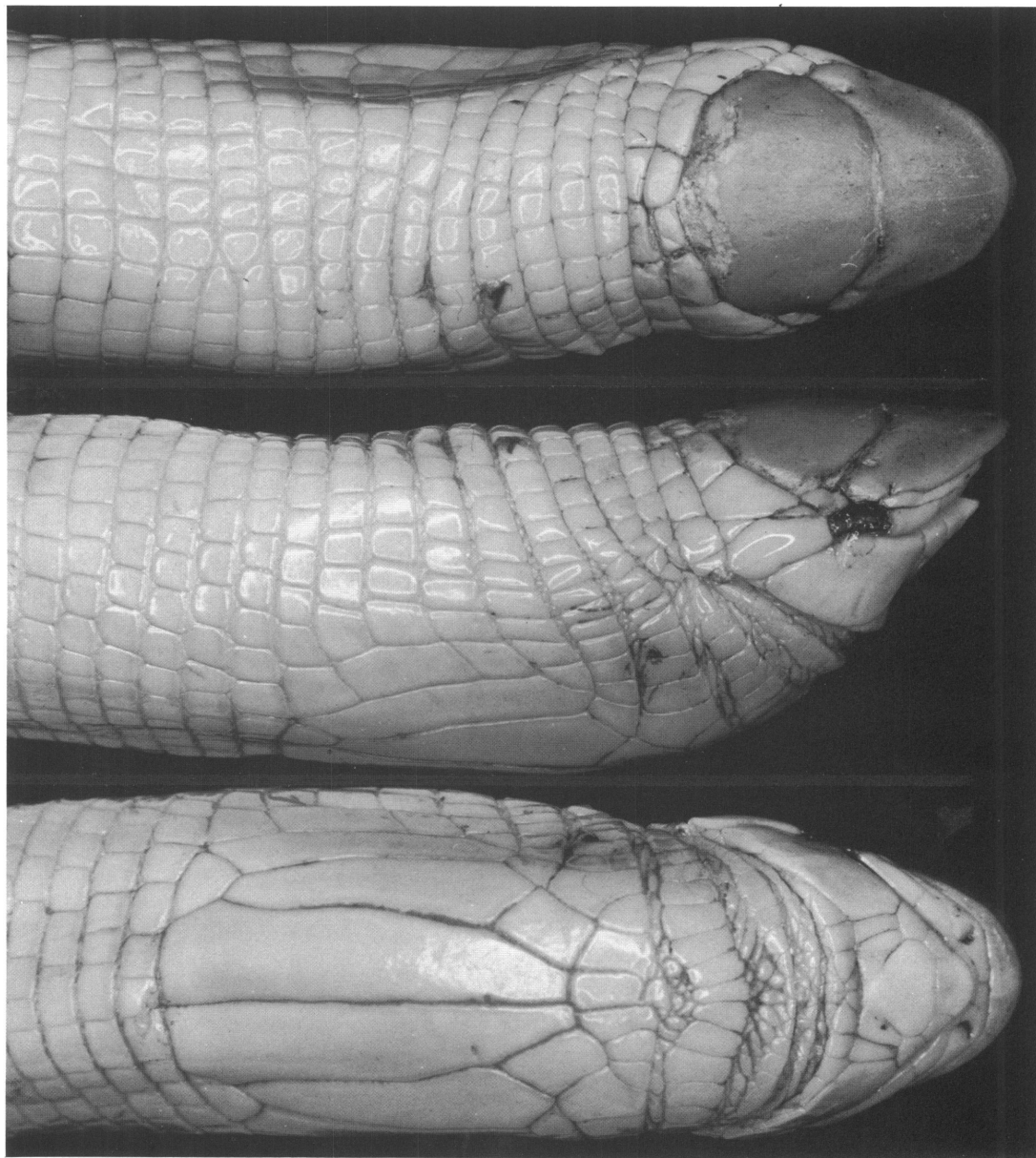

FIG. 123. *Dalophia gigantea.* Dorsal, lateral, and ventral views of head of the syntype MSNG CE 36071, no data.

RGMC 32, the smallest specimen seen, the heavy keratinization is most marked on the spade, the medial isthmus and the center of the posterior shield, whereas the lateral, preocular, and posteriorly peripheral regions show a much thinner coat.

The preoculars are large and generally well defined (except in the syntype where part of their anterior raphe is fused). They are unique in the group in that they occupy the entire postero-lateral corners of the first azygous shield, rather than being inserted into its posterior edge with a strip of shield lateral to them (compare illus-trations for *D. welwitschii* and species of *Mono-peltis*). The preoculars are in ventral contact with postnasal and second supralabial. The eye is very faintly visible beneath the quadrangular ocular, which is in contact dorsally with the second azygous shield, anteriorly with the preocular, ventrally with the second supralabial, and poste-riorly with a tiny triangular temporal. Sometimes it contacts a more dorsal and larger segment, that may be defined either as a discrete postocular plus the first parietal, or as the first and second parietals of the row of eight that dorsally connect the third supralabials and separate the head shields from the first body annulus.

The crescent-shaped nostrils are inserted in the relatively long nasals that generally contact

the preoculars, although their posterior tips may form a separate segment. The nasals are in broad medial contact with each other, but well separated from the lips. There are three supra-labials, the second the longest, the third the tallest.

The lower jaw is covered by a wide mental with flaring lateral edges that show an anteriorly rounded projection and is in more or less straight contact with the postmental, by the small first, second, and enormous third infralabials, as well as by the squat, septangular postmental (genial). The elongate rectangular lateral seg-ments of the first row of postgenials rarely make even point contact with the postmental. Medially they are joined by the triangular second pair of the row which are in point contact with each other posterior to the blunt postmental apex. There are eight to 10 segments to the second row of postgenials which lie anterior to the first deep gular fold.

The modified pectoral region extends to the eighth through tenth body annuli. There are six elongate subparallel pectoral shields, the median the longest and posteriorly the widest, the next lateral the widest anteriorly and the lateralmost parallel-sided (some of the more lateral segments may also be asymmetrically fused). This smooth zone corresponds to five or six dorsal half-annuli. The medial segments of an anterior annulus are variably enlarged and also incorporated into the pectoral zone.

There are 316 to 321 body annuli from the posterior edge of the third infralabial up to (but not including) the precloacal shields. There is a tendency to a few supernumerary half-annuli in the second 50 body annuli. A midbody annulus has 19 to 24 (generally 20) dorsal plus 16 to 19 (generally 18) ventral segments. The middorsal segments are approximately one and one-half to two times as long as wide and the midventral segments slightly wider than long. The number of dorsal segments is slightly greater than the number of ventral segments in any specimen.

There are generally four lateral annuli, the first one or two in contact with the small lateral segments of the six (the medial pair the largest) forming the precloacal shield. There are no pre-cloacal pores.

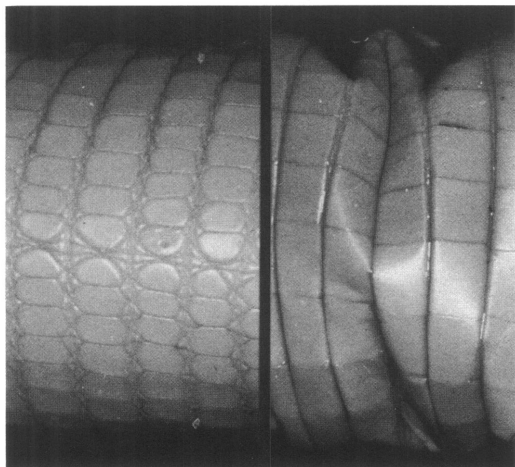The tail is round in section, stout, and shows a

FIG. 124. *Dalophia gigantea.* Left, dorsal view, and right, ventral view at midbody of RGMC 4577 from Kwango, Zaire.
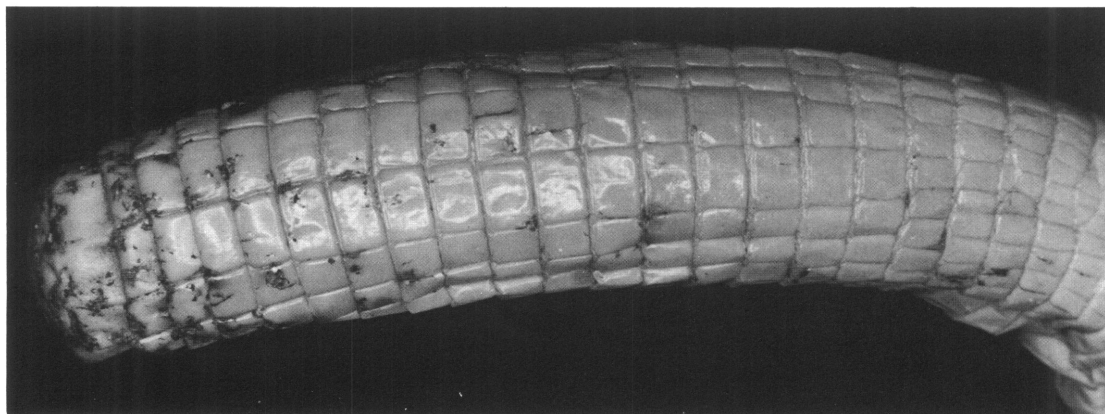
FIG. 125. *Dalophia gigantea*. Lateral view of cloaca and detail of the syntype MSNG CE 36071, no data. Note robust tail, absence of autotomy annulus and truncate terminal shield.

slight ventral curve near its distal tip. The vertical dimension increases near its base and decreases again over the terminal four of the 21 to 23 caudal annuli. There is no autotomy and the unsegmented caudal cap is about one annulus thick and presents a smooth, oval callous surface that may extend slightly onto the dorsal surface as well. The medial row of dorsal segments is significantly widened posterior to the caudal base, but the interannular sutures cross the tail at right angles to its long axis.

The lateral sulci are well marked and approximately as wide as an adjacent segment. The mid-dorsal sulcus is clearly marked but somewhat narrower. There are no diagonal folding lines and the ventral sulcus is only indicated by alignment of intersegmental raphes.

Locality Records. ZAIRE: No Data: *IMZUT 2844; MSNG CE36071 (Syntypes *M. giganteus* Peracca, 1903, Loveridge, 1941). Popokabaka (Kwango): RGMC 32 (Holotype *M. truncata* Witte, 1922, 1927, 1942, 1954; Loveridge, 1941; Witte and Laurent, 1942), RGMC 4574 (Witte and Laurent, 1942; Witte, 1954). Ngada-Sainte-Famille (Kwango): RGMC 4573 (Witte and Laurent, 1942; Witte, 1954).

Dalophia longicauda (Werner)
Figures 33, 34, 126-130

Monopeltis colobura (*longicauda*, new species?) Werner, 1915, p. 340. *Terra typica*:

"Okawango" (between 19° and 21°30'E longitude), South-West Africa. Holotype: HM 4275.
Dalophia longicauda: Loveridge, 1941, p. 432.

Diagnosis. A medium to large (360 to 520 mm. snout-vent length in adults) species of *Dalophia*, with the dorsal surface (particularly of the posterior portion of the body) darkened by gray speckling that may concentrate at the annular edges. The species has 307 to 338 body, two to five lateral and 33 to 42 caudal annuli, 18 to 24 (generally 20 or 22) dorsal plus 12 to 16 (generally 14) ventral segments to a midbody annulus and three to six (generally four or five) first and eight to 13 (generally nine, 10, or 11) second postgenials. The azygous head shields are broadly fused and only blind lateral sutures remain. There are no preoculars. The nasals are usually in median contact and usually just fail to reach the lip, their slender posterior processes (or asymmetrically split off postnasals) make contact with the oculars. There are four parietal shields. The pectoral region has six elongate shields, often somewhat irregularly arranged, but with the median pair always widest posteriorly. The four midventral segments of the prepectoral annulus are more or less wedged between the medial and adjoining pairs of pectorals. Lateral sulci are clearly expressed, as is the middorsal one after the first third of the trunk. There are generally a few supernumerary dorsal half-annuli,
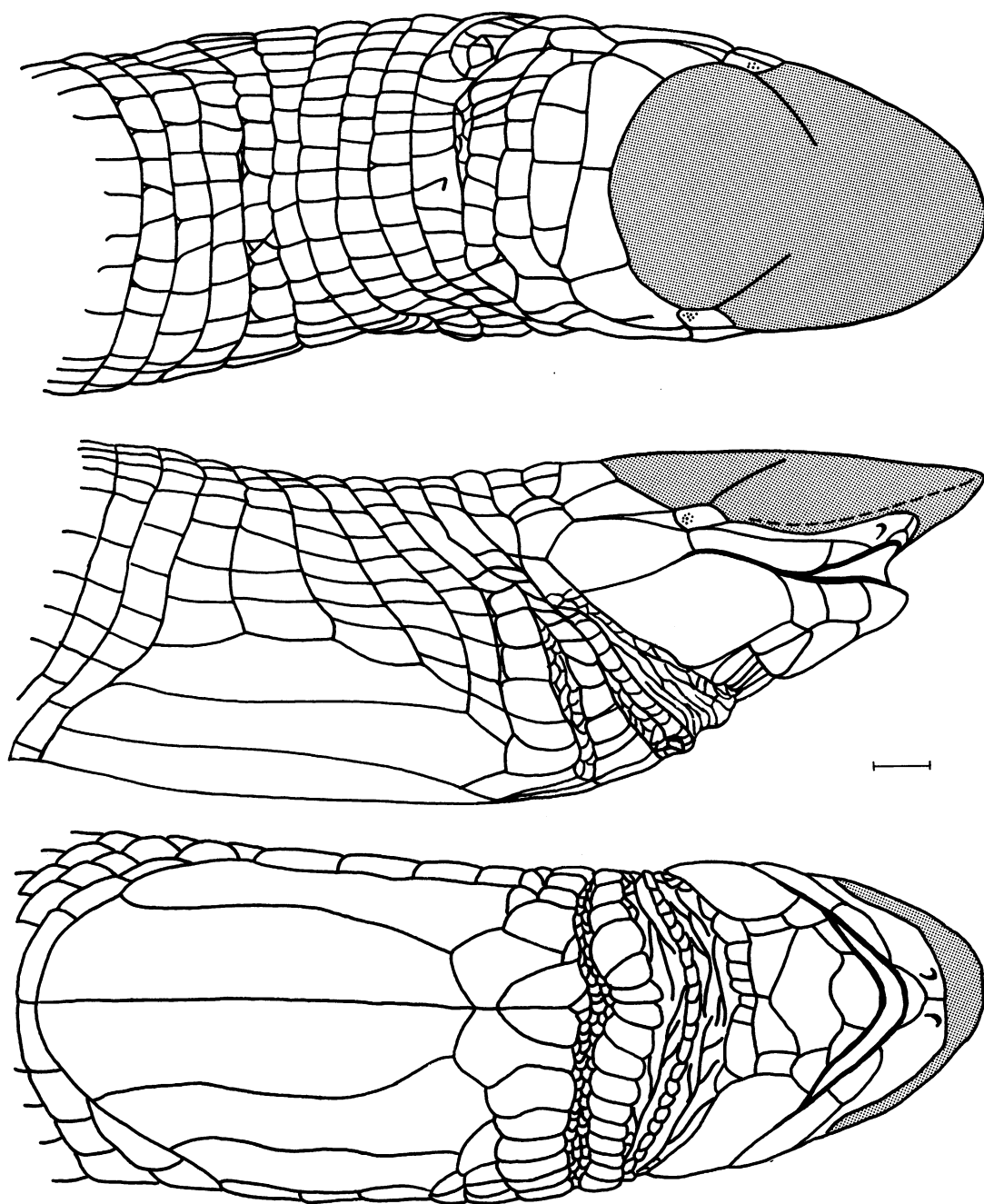
FIG. 126. *Dalophia longicauda.* Pattern of head scalation. Dorsal, lateral, and ventral views of head and pectoral region of UM 23056 from 15 km. WSW of Katima Mulilo, Caprivi Strip, South West Africa. The line equals 1 mm. to scale.

mainly in the second 50 body annuli. The dorsal interannular sutures of the postnuchal region tend to form a herrringbone pattern, the angle of which is affected by the degree to which the

head is raised. There is no autotomy annulus. The middorsal segments of the tail are partially or completely fused across the midline. The interannular sutures here form an anteriorly acute set of angles with the median (their points may be rounded). Each leg of the chevron is as wide as three or four more anterior segments.

Description. This is a medium to large-sized species with the available specimens ranging from 155 to 520 mm. in snout-vent length (fig. 35).
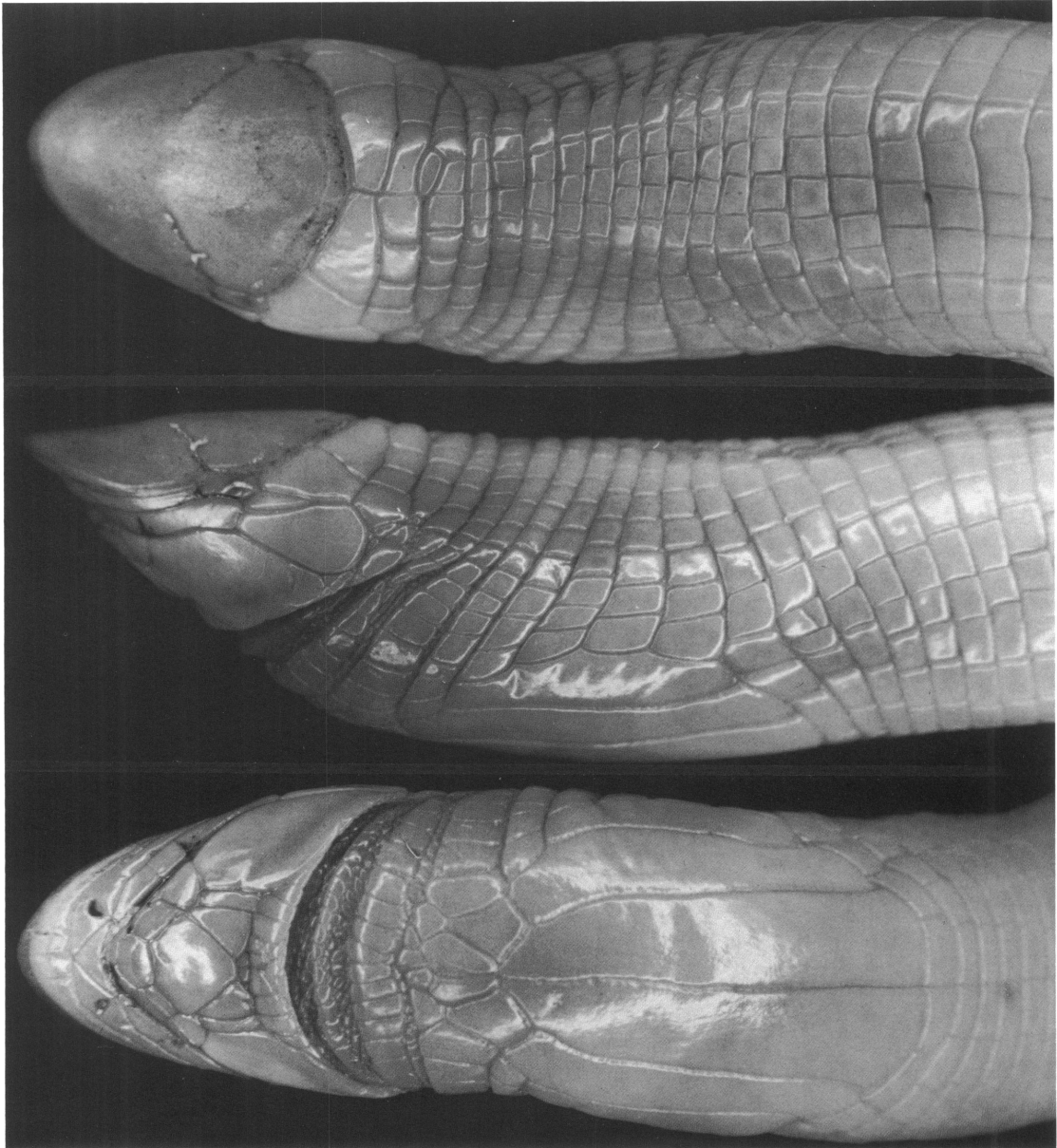

FIG. 127. *Dalophia longicauda.* Dorsal, lateral, and ventral views of the head of UM 23055 from 15 km. WSW of Katima Mulilo, South West Africa.
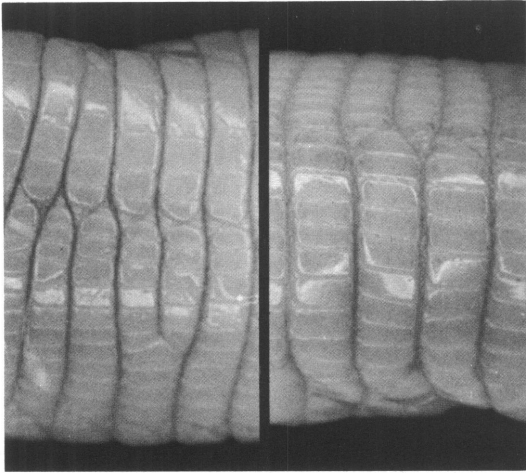
FIG. 128. *Dalophia longicauda.* Left, dorsal view, and right, ventral view at midbody of UM 23055 from 15 km. WSW of Katima Mulilo, South West Africa.

The head and first 30 body annuli are unpigmented but the rest of the dorsum is lightly speckled with gray, the pigmentation being concentrated toward the edges of annuli and extending ventral to the lateral sulci; the pigmentation on the tail may extend right across the ventral segments.

The azygous large head shields are always fused to form an oval shield, more or less pointed anteriorly and notched laterally to accommodate the oculars, from which blind lateral sutures extend anteriorly. The dorsal surface of the head is concave anteriorly and convex posteriorly; it forms a sigmoid curve in profile.

The eye is usually visible as a dark spot beneath the subhexagonal ocular. Two pairs of parietals separate the large head shield from the first body annulus; the medial pair is the widest. An elongate triangular postocular is usually wedged between the outer parietal and the third supralabial.

The nostrils are crescent-shaped and are inserted into elongate nasal scales that make contact with the oculars (or asymmetrically split off postnasals); they are usually in good contact with one another dorsal to the triangular rostral and usually just fail to reach the lip. There are three supralabials, the second the longest.

The lower jaw is formed by a squarish mental, the first, second, and enormous third infralabials and a large shield-shaped postmental (genial). Posterior to the postmental are three to six (usually four or five) first and eight to 13 elongate second postgenials. The postmental may contact the second row of postgenials on the midventral line, or the large median pair of first postgenials may be separated by a small azygous scale.

The modified pectoral region extends to the ninth through the twelfth body annulus; there are six elongate shields, the medial pair widened posteriorly, the lateral pair often shorter than the inner ones and corresponding to only four or five, instead of six, dorsal half-annuli. The four midventral segments of the prepectoral annulus are enlarged and the outer pair are diamond-shaped and wedged between the two inner pairs of pectorals. The whole pectoral region projects posteriorly in a semicircle that strongly distorts the first postpectoral annulus and the succeeding few to a lesser extent.

There are 307 to 338 body annuli from the posterior edge of the third infralabial up to (but not including) the precloacal shields. Supernumerary dorsal half-annuli are usually few (maximum 13 in UM 23057) and mostly fall in the second 50 body annuli. A few dorsal half-annuli drop out here and there. A midbody annulus has 18 to 24 dorsal plus 12 to 16 ventral segments. The middorsal segments are approximately two to three times as long as wide and the midventral segments one and a-half to three times as wide as long. Intersegmental raphes are
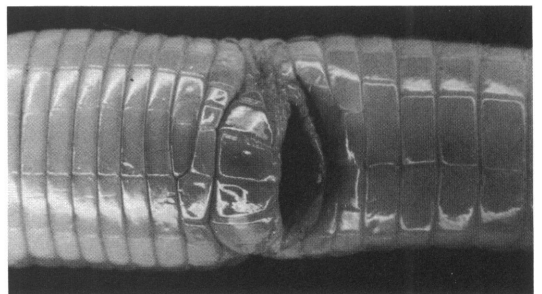

FIG. 129. *Dalophia longicauda.* Ventral view of cloaca of UM 23053 from 15 km. WSW of Katima Mulilo, South West Africa.
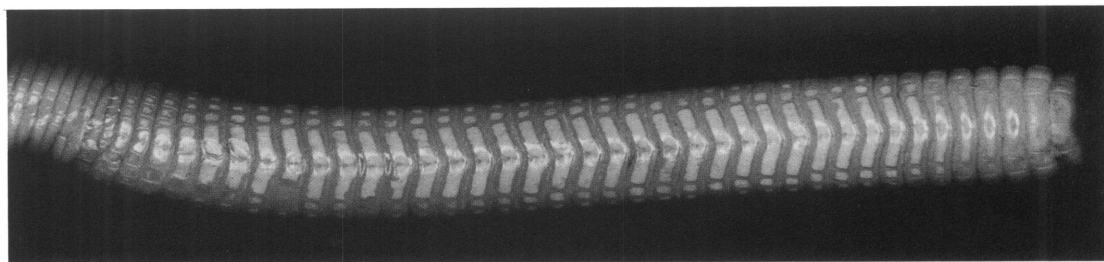
FIG. 130. *Dalophia longicauda*. Dorsal view of tail of HM 4275 from Okavango, South West Africa to show herringbone pattern of dorsal segmentation.

more or less parallel to the longitudinal body axis.

There are two to five lateral annuli and four to six precloacal segments. There are no precloacal pores.

The elongate tail (fig. 36) appears subcylindrical or slightly flattened above and below in cross section and terminates in an unsegmented callous pad. The middorsal segments (except for a few proximal ones) are fused and form posteriorly directed chevrons; there may also be a few fused midventral segments. There are 33 to 42 caudal annuli and no trace of autotomy, despite extensive damage to the tails of some specimens by bulldozers.

The lateral and middorsal sulci are distinct. There are no diagonal folding lines on the body.

Locality Records. SOUTH WEST AFRICA: Okavango: HM 4275 (Holotype *M.? colobura* [*longicauda*, new species?] Werner, 1915; Loveridge, 1941). 15 km. WSW of Katima Mulilo, Caprivi Strip: AMNH 112960-112963; UM 21379-21399, 23049-23058, 23061, 24253, 24255-24259, 24261, 24263-24267.

BOTSWANA: Tamafupi: UM 10336.

RHODESIA: Victoria Falls: UM 20571, 23218, 28075. Wankie National Park, Main Camp: UM 26603, 27864, 29583.

Biological Miscellanea. Rhodesian and Caprivi specimens recovered from stomachs of quill-snouted snakes *Xenocalamus mechowii inornatus* (Broadley, 1971b).

Dalophia pistillum (Boettger)
Figures 33, 34, 131-136

Monopeltis pistillum Boettger, 1895, p. 62. *Terra typica*: "Sambesi, Ostafrica." Here restricted

to "Boroma, 20 km. upstream from Tete, Mozambique." Lectotype (by present designation): SMF 11833 (formerly 5455 2a). Paralectotypes: NMW 12345:1; one missing.

Monopeltis granti Boulenger, 1907c, p. 485. *Terra typica*: "Beira, Portuguese East Africa." Mozambique. Holotype: BM 1907.4.29.33:-RR1946.8.31.98.

Monopeltis colobura Boulenger, 1910, p. 495. *Terra typica*: "Sesheke, Barotseland," Zambia. Syntypes: BM 1910.6.18.11:RR-1946.8.8.96; SAM 4661 and 4663.

Monopeltis jallae Peracca, 1910, p. 1. *Terra typica*: "Zambese (Barotseland)," Zambia. Syntypes: IMZUT 4011; MSNG CE 37466.

Monopeltis granti transvaalensis FitzSimons, 1933, p. 277. *Terra typica*: "Hope, between Nylstroom and Vaalwater, Waterberg District, northern Transvaal," South Africa. Holotype: TM 14354. Paratype: TM 14353.

Monopeltis mossambica Cott, 1934, p. 155. *Terra typica*: "Caia," Mozambique. Holotype: BM 1933.7.1.2: RR 1946.8.31.99. Paratype: BM 1933.7.1.86.

Monopeltis granti kuanyamarum Monard, 1937, p. 67. *Terra typica*: "Mupanda," Angola. Holotype: LCFM (unnumbered).

Dalophia pistillum: Loveridge, 1941, p. 434.

Diagnosis. A medium to large (320 to 560 mm. snout-vent length in adults) species of *Dalophia*, with the dorsal surface (generally to just ventral of the lateral sulci, sometimes irregularly more ventral, particularly beneath the tail) with gray speckling that may concentrate along the annular and segmental edges. The species has 280 to 352 body, two to five lateral and 19 to 33 caudal annuli, 17 to 30 (generally 20, 22, or 24) dorsal plus 12 to 17 (generally 14) ventral segments to a midbody annulus and two
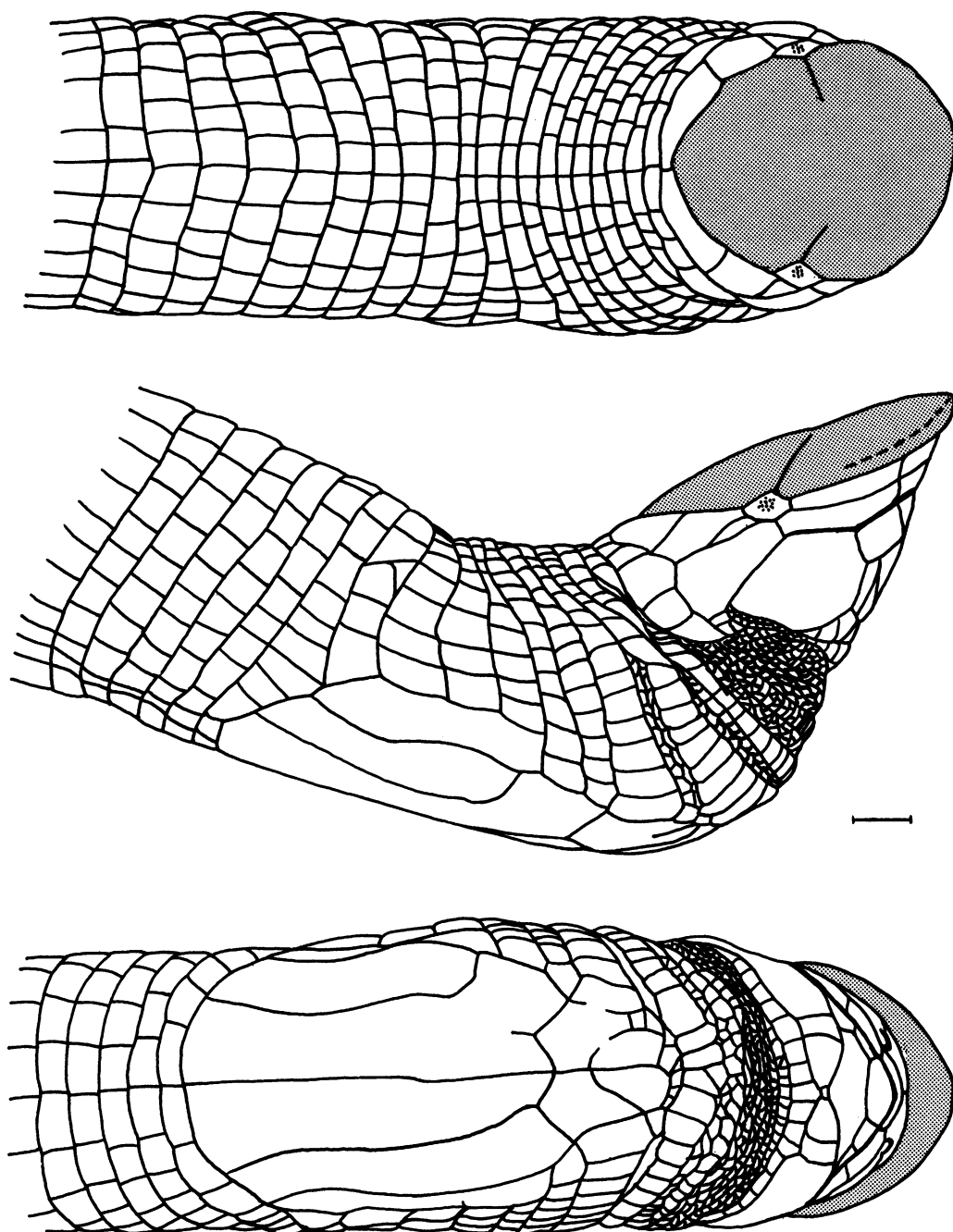
FIG. 131. *Dalophia pistillum.* Pattern of head scalation. Dorsal, lateral, ventral views of head and pectoral region of UM 7206 from 30 km. N of Tamafupi, Botswana. The line equals 1 mm. to scale.

to six (usually four) first and seven to 14 (generally nine to 10) second postgenials. The

azygous head shields are broadly fused and only blind lateral sutures remain (absent in one speci-

men). The most heavily keratinized zone does not reach the parietal edge of the shield and is also scalloped medially over the blind sutures.

There are no preoculars. The nasals are usually in median contact and usually just fail to reach the lip, their slender posterior processes (or
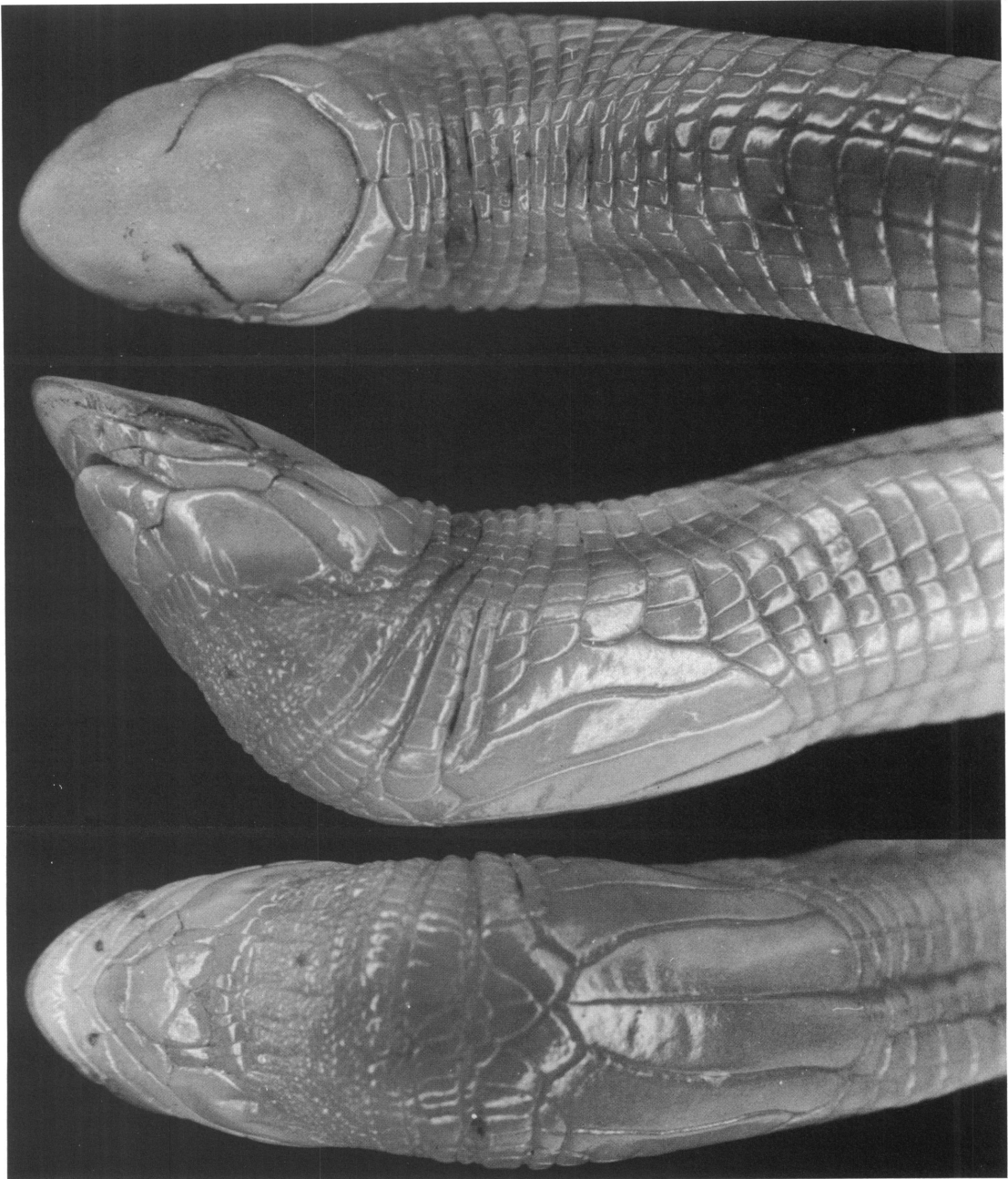

FIG. 132. *Dalophia pistillum.* Dorsal, lateral, and ventral views of head of CG 4825 from Kalabo, Zambia.

asymmetrically split off postnasals) usually contact the oculars. There are four (rarely six) parietal shields. The pectoral region has six elongate shields, often somewhat irregularly arranged and with the medial pair much the widest posteriorly. The four midventral segments of the precloacal annulus are enlarged and more or less wedged between the medial and adjoining pairs of pectorals. Lateral and middorsal sulci are clearly expressed, particularly in larger specimens. Additions or subtractions of dorsal half-annuli are few, but occur mainly in the second 50 body annuli. The species lacks a herringbone pattern of dorsal interannular sutures on the trunk as well as caudal autotomy. The middorsal segments of the tail may be partially or completely fused across the midline. The interannular sutures here form an anteriorly acute set of angles with the median (their points are often rounded). Each leg of the chevron is as wide as three or four more anterior segments. [See section on geographic variation.]

Description. This is a medium to large-sized species, with the available specimens ranging from 130 to 560 mm. snout-vent length (fig. 35). The anterior quarter of the body is usually unpigmented, but thereafter there is light gray speckling on the dorsum that may concentrate along the annular sutures; sometimes this

FIG. 133. *Dalophia pistillum.* Left, dorsal view, and right, ventral view at midbody of CG 4825 from Kalabo, Zambia.

speckling extends irregularly ventral to the lateral sulci, whereas on the tail the pigmentation may extend right across the ventral segments. In UM 22703 the posterior three-quarters of the dorsum is heavily pigmented with gray and there are gray blotches on the dorsal surface of the tail including the caudal cap.

The azygous large head shields are always fused to form an oval shield, more or less pointed anteriorly, with lateral blind sutures that are retained throughout life (lost in UM 22703). The dorsal surface of the head is concave anteriorly and convex posteriorly, forming a sigmoid curve in profile.

The eye is usually visible as a dark spot beneath the subhexagonal ocular. Two (rarely three) pairs of parietals separate the head shield from the first body annulus; the medial pair is the widest. An elongate triangular postocular is usually wedged between the outer parietal and the third supralabial.

The nostrils are crescent-shaped and are inserted into elongate nasal scales that are usually in contact with the oculars (or asymmetrically split off postnasals), except in some eastern specimens in which they are well separated. The nasals are usually in good contact with each other above the triangular rostral; they usually just fail to reach the lip. There are three supralabials, the second the longest.

The lower jaw is formed by a squarish mental, the first, second, and enormous third infralabials and a large shield-shaped postmental (genial). Posterior to the postmental are two to six (usually four) first and seven to 14 elongate second row postgenials. The medial first row postgenials may be separated by the distal wedge of the postmental.

The modified pectoral region extends to the ninth to twelfth body annulus. There are six elongate shields; the median pair is much widened posteriorly, the lateral pair often shorter than the medial ones and corresponds to only two to five, instead of six, dorsal half-annuli. The four midventral segments of the prepectoral annulus are enlarged and the outer pair of these are wedged between the first and second pairs of pectorals. The entire pectoral region projects posteriorly in a semicircle which distorts the postpectoral annulus strongly and the succeeding few to a lesser extent.
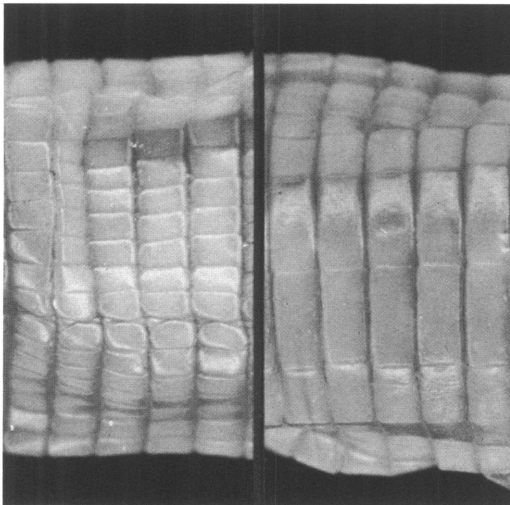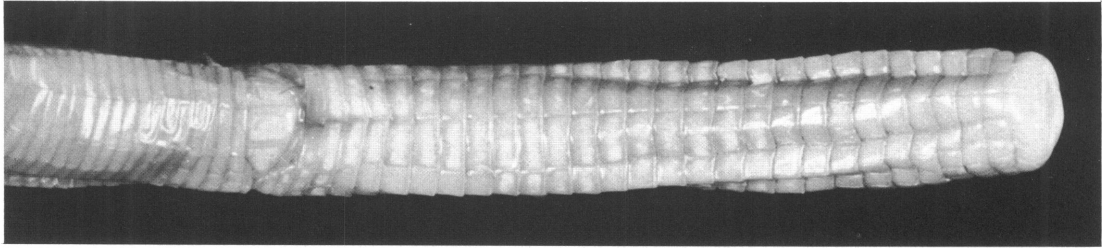
FIG. 134. *Dalophia pistillum*. Ventral view of tail of CG 3825 from Kalabo, Zambia.

There are 280 to 352 body annuli from the posterior edge of the third infralabial up to (but not including) the precloacal shields. A few dorsal half-annuli may be added or subtracted, mainly in the second 50 body annuli. A midbody annulus has 17 to 30 dorsal plus 12 to 17 ventral segments. The middorsal segments are approximately two to three times as long as wide and the midventral segments one and a-half to three times as wide as long. Only anteriorly is there a slight tendency for sutures between dorsal segments to be angled to form posteriorly directed chevrons.

There are two to five lateral annuli and four to six precloacal segments, the median pair the largest. There are no precloacal pores.

The moderate tail (fig. 36) appears slightly flattened dorsally and ventrally and terminates in an unsegmented callous pad. The middorsal segments are usually partially or completely fused to form posteriorly directed chevrons (not fused or chevron shaped in UM 22703). There are 19 to 33 caudal annuli and no autotomy.

The lateral and middorsal sulci are distinct. There are no diagonal folding lines on the body.

Locality Records. ANGOLA: Mupanda LCFM (unnumbered) (Holotype *M. granti kuanyamarum* Monard, 1937; Loveridge, 1941).

SOUTH WEST AFRICA: Grootfontein: ZMU 23383, 23384, 23387 (Sternfeld 1911b; Nieden, 1913; Loveridge, 1941). Labora. Farm: TM 33232-33233, 33235. 15 km WSW of Katima Mulilo: UM 21378.

SOUTH AFRICA: *Cape Province*: Zoetvlei, near Vryburg: AMG 6733b (FitzSimons, 1943). *Transvaal*: Farm "Hope" between Nylstroom and Vaalwater, Waterberg District: TM 14353 (Paratype), 14354 (Holotype, *M. granti transvaalensis* FitzSimons, 1933, 1943; Loveridge, 1941).

BOTSWANA: Chief's Island, Okavango Swamps: TM 42976. Moremi Game Reserve: UM 20153-20155. Khwai: UM 28213-28214. 15 km S of Maxwee: UM 25433-25435. 30 km N of Tamafupi: UM 7206. Tsau: UM 10371. Maun: UM 18095, 29160. Shorobe: UM 20773-20777. Ghanzi: BM 1933.9.9.15. Dekar: TM 26975. Kangyane Pan: UM 13032-13038. 40 km S of Tshane: UM 22163. 55 km S of Tshane: UM 22357-22359. Lekuru Pan: UM 22477. Mabua Sehubi Pan: UM 13053-13054. Boshu Boholu Pan: UM 22739. Xhenga Island, Boro River (1932 C2): TM 45683.

RHODESIA: Wankie National Park–Dandari Pan: UM 28303. Sinamatela: UM 23671-23672. Deka: NMSR 1184 (Chubb, 1909; Broadley, 1962). Kapami: UM 535 (Broadley, 1962). 10 km SE of Kapami: CG 2735a-2735b, MCZ 67786-67787, UM 495-497, 626 (Broadley, 1962). Dett: AMNH 113085, 113086, UM 2528, 3046, 7927, 7928, 18038-18039, 20274-20275, 21569, 23491. Binga: UM 20305. Chizarira Game Reserve: UM 28421; Muchesu Firebreak: UM 21714-21715, 21728-21729. Manzituba Camp: UM 21745, 26795. Lusulu: UM 10574. Charama Plateau: UM 10571. Kariba Lake–Bumi Confluence: NMSR 3581, 5045 (Broadley, 1962). Kariba Lake– Sanyati Basin: NMSR 3580 (Broadley, 1962). Karoi: UM 10374. Rakute Farm, Doma: UM 12569. Mana Pools: UM 5556. *No locality*. CG 1588.

ZAMBIA: Kalabo: AMNH 113083, 113084; CG 4824-4825; FMNH 133020, 142684, 142694; TM 33891-33893; UM 4826, 6901, 7910, 10076, 10079-10082, 21026-21030. Lealui District: MNHP 20-76, 20-77 (Angel, 1920; Loveridge, 1941). Alto Zambese, Barotseland: IMZUT 4011; MSNG/CE 37466 (Syntypes of *M. jallae* Peracca, 1910; Loveridge, 1941).
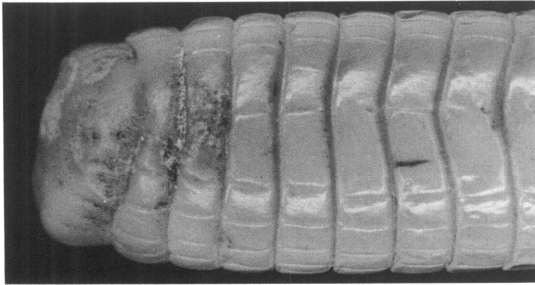
FIG. 135. *Dalophia pistillum.* Dorsal surface of caudal tip to show terminal pad and caudal chevrons of NMSR/M 2101 from Livingstone, Zambia.

Kabompo: NMSR 4966 (Broadley, 1971a). Kasempa District: TM 39634. Sesheke: BM 1910.6.18.11:RR1946.8.8.96; SAM 4661, 4663 (Syntypes of *M. colobura* Boulenger, 1910; Pitman, 1934; Loveridge, 1941; FitzSimons, 1943). Livingstone: NMSR 2101-2102; Pendela River: NMSR 2103. Chakwenga River: UM 4500-4501. Katete: UM 9441 (Broadley, 1971a). 25 km NE of Lundazi: UM 3064.

MOZAMBIQUE: Lumbo: AMNH 16822; BM 1920.5.4.16; USNM 62854 (Loveridge, 1920, refers to a male and half-dozen females). Boroma Mission: SMF 11833 (ex 54558a) (Lectotype of *M. pistillum* Boettger, 1895; Mertens, 1922, 1967), NMW 12354:1 (Lectoparatype of *M. pistillum* Boettger, 1895), Caia: BM 1933.7.1.2: RR1946.8.31.99 (holotype of *M. mossambica* Cott, 1934; Loveridge, 1941), 1933.7.1.86. (Paratype of *M. mossambica* Cott, 1934). Inhamitanga: UM 22703, Beira: BM 1907.4.29.33: RR1946.8.31.98 (Holotype *M. granti* Boulenger, 1907; Loveridge, 1941).

Biological Miscellanea. Caia specimen contained remnants of coprophagous or ligniphagous beetle larvae (Cott, 1934).

At Lumbo, two specimens taken at the end of August contained four eggs each; these measured 35 by 10 mm. and 35 by 9 mm. respectively. Another specimen laid four eggs either during the night or in the early morning of September 20. No two of these eggs were of the same size; their measurements in millimeters were as follows: 35 by 8, 32 by 8, 30 by 9, 26 by 9. Several

specimens had been driven to the surface by "ant of a subterranean species which . . . will eat a dead body from beneath" (Loveridge, 1920).

Three Zambian specimens were from stomachs of quill-snouted snakes *Xenocalamus mechowii* ssp. (Broadley, 1971b).

Specimen from Dekar left tracks in sand leading to tuft of grasses beneath which it was dug up at a depth of 20 to 30 cm.

Two specimens show everted hemipenes. In TM 42976, the hemipenis is about as long as three adjacent annuli, the head is T-shaped and each of its wings is one and a-half annuli long. A
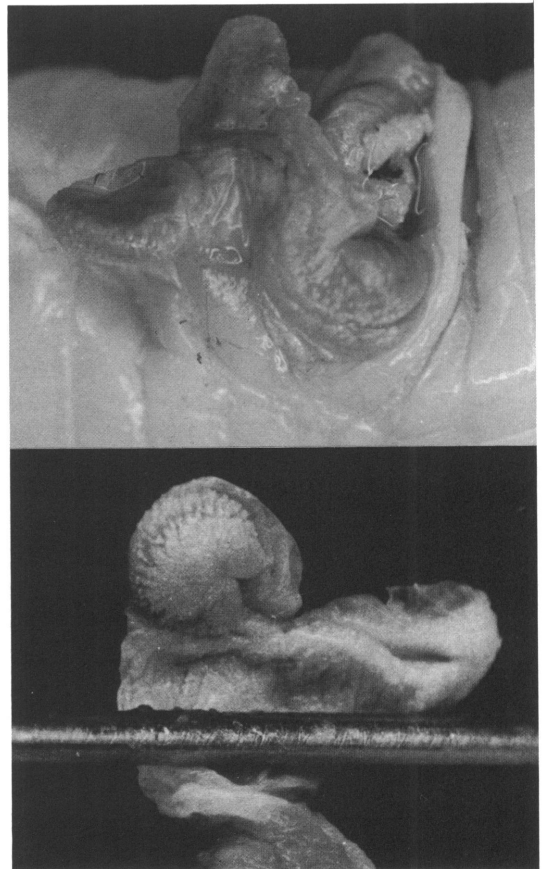

FIG. 136. *Dalophia pistillum.* Hemipenes of TM 42976 from Chief's Island, Okavango Swamp, Botswana. Note double head. Top, view of cloacal region, and bottom, detail of spinose head.

deep sulcus leaves the medial portion of the base, swings posterolateral, then ascends the posterior surface of the shaft in a sinuous curve. Upon reaching the saddle it crosses and ascends the two heads on their anterior side. The posterior surface of each head is covered with a thin and smooth membrane. Each groove ends in the center of the anteriorly facing spinose pad (fig. 136).

Dalophia luluae (Witte and Laurent),
new combination
Figures 137-140

Monopeltis luluae Witte and Laurent, 1942, p. 68. *Terra typica*: "Sandoa (Ht. Lomami)," Zaire. Holotype: RGMC 10848.

Diagnosis. A species of *Dalophia* lacking pigmentation and having 314 body and 16 caudal annuli, 16 to 18 dorsal plus 14 ventral segments to a body annulus and four first plus eight second postgenials. The head shields are broadly fused in the unique subadult specimen and only the lateral blind sutures remain. There are no preoculars and the nasals (in point contact medially) send long wings to contact the oculars. There are six pectoral shields; all contact the curved posterior edge of the zone and the two medial pairs extend anteriorly into two annular rows. Lateral and middorsal sulci are deeply expressed. The specimen lacks caudal autotomy. There is a faint herringbone effect of dorsal interannular sutures near the end of the first 50 body annuli; the dorsal segments of the caudal annuli are neither fused nor angled.

Description. This is a small-sized species of *Dalophia* with the unique (and severely damaged) specimen 260 mm. snout-vent length (fig. 35). The holotype is faded so that no trace of pigmentation remains.

The azygous head shield is single, more or less pointed anteriorly, and oval (as well as severely abraded in the type); blind, anteriorly directed sutures enter from the anterior tip of the oculars for a fifth of the width. The dorsal surface of the head is faintly convex throughout.

The eye is clearly visible as a dark dot beneath the tiny, subhexagonal ocular which is in contact anteriorly and dorsally with the azygous shield, anteroventrally with the nasal, ventrally with the

second supralabial, and posteriorly with the first of four parietals (the medial pair the longest) that connect dorsally between the third supralabials and separate the head shields from the first body annulus.

The nostrils are crescent-shaped and inserted into elongate nasals that send long posterior processes to contact the oculars and are in narrow medial contact with each other, but not with the lip. There are three supralabials, the second the longest, the third the largest and tallest.

The lower jaw is covered by a squarish mental with flaring anterior wings and a straight posterior suture, the first, second, and enormous third infralabials, and a large heart-shaped postmental (genial). The two rectangular lateral first postgenials contact the postmental and second infralabials. The medial, triangular first postgenials flank the posteriorly pointed tip of the postmental and do not contact each other. There are eight slightly shorter second postgenials anterior to the gular fold.

The modified pectoral region extends to the twelfth body annulus. There are six elongate and subparallel pectoral shields, the posteriorly widest median pair the largest, the next, more lateral pair widest anteriorly and the irregular lateral pair the shortest. The last corresponds to five dorsal half-annuli, whereas the more median pairs correspond to six or seven. The median segments of the next, more anterior annulus are enlarged and those segments flanking the midline insert between the two median pairs of pectorals. The entire pectoral region projects posteriorly in a semicircle that distorts the postpectoral annulus strongly and the succeeding few to a lesser extent.

There are approximately 314 body annuli from the posterior edge of the third infralabial up to (but not including) the precloacal shield. Two dorsal half-annuli are dropped in the first 50 body annuli and two added in the second. A midbody annulus has 16 to 18 dorsal and 14 ventral segments. The middorsal segments are approximately one and one-half times as long as wide and the midventral segments two times as wide as long. Only anteriorly, but posterior to the pectoral region, is there a slight tendency for the
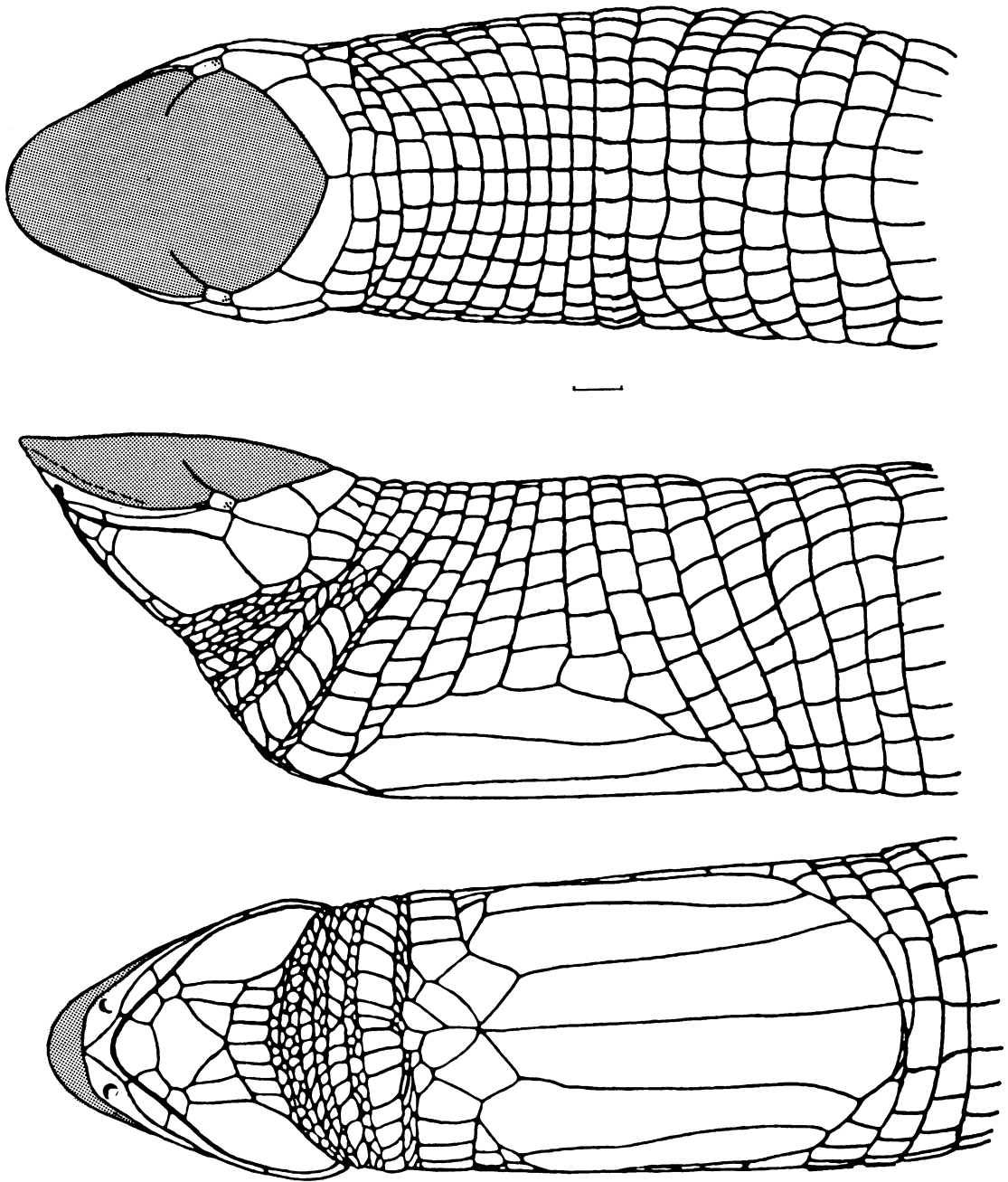
FIG. 137. *Dalophia luluae*. Pattern of head scalation. Dorsal, lateral, and ventral views of head and pectoral region of holotype RGMC 10848 from Sandoa, Zaire. The line equals 1 mm. to scale. (After Witte, 1954).

sutures between dorsal segments to angle into posteriorly directed chevrons.

There are five lateral annuli, two of which contact the outermost of the six precloacal

segments, the median pair of which is the largest. There are no precloacal pores.

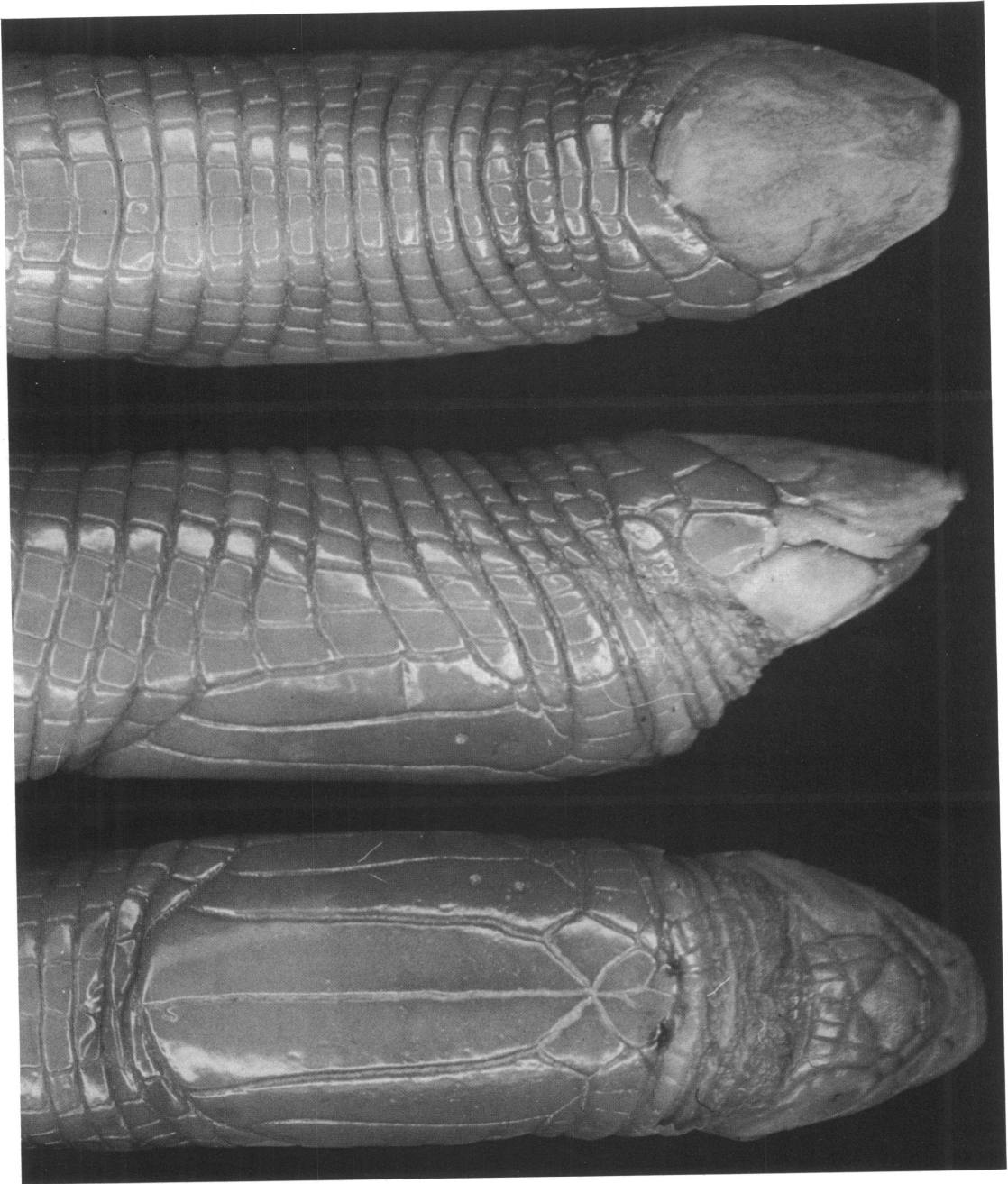The medium-sized tail appears slightly compressed laterally. It is markedly reduced in

FIG. 138. *Dalophia luluae.* Dorsal, ventral, and lateral views of head and neck of the holotype RGMC 10848 from Sandoa, Zaire.
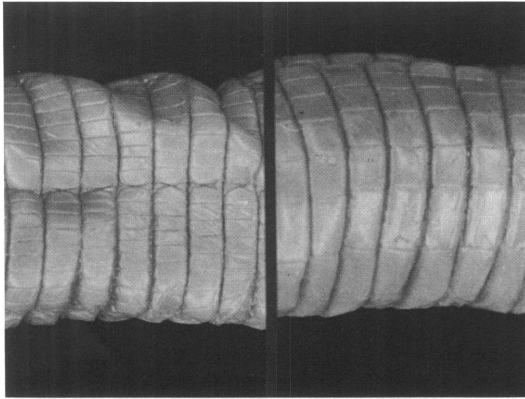
FIG. 139. *Dalophia luluae.* Left, dorsal view, and right, ventral view of midbody of the holotype RGMC 10848 from Sandoa, Zaire.

height over the last six of 16 caudal annuli, and terminates in a projecting and unsegmented callous pad slightly longer than a preceding annulus. In dorsal view the interannular sutures cross the tail in an anteriorly open curve (without herringbone effect). There is no autotomy.

The lateral and dorsal sulci are deep and distinct; the former is as wide or wider than an adjacent segment; the latter is narrower. There are no diagonal folding lines on the back and the ventral sulcus is only indicated by aligned intersegmental raphes.

Locality Records. ZAIRE: Sandoa (Haut Lomami): RGMC 10848 (Holotype *M. Luluae* Witte and Laurent, 1942; Witte, 1953, 1954).

DISCUSSION

STRUCTURAL SEQUENCES IN EXTERNAL SEGMENTATION

As already noted by Laurent (1954) the pectoral shields form a general sequence in their complexity from south to north. The southernmost species (*M. capensis, M. anchietae,* and *M. leonhardi,* as well as *M. zambezensis* and the single individual of *M. kabindae*) show various degrees of fusion in the ventral segments of the three or four body annuli corresponding to the pectoral region. These combine into two or three parallel shields on each side of the ventral surface. The lateralmost of these shields are often shorter; their anterior and posterior ends may be defined by partial sutures retaining an irregular and often asymmetrical pattern. The ventral segments of that annulus just anterior to the zone of fusion are somewhat larger than are the ventral segments of the postpectoral annuli. Ordinarily, these segments are contiguous with the pectoral zone, but are separated off the pectoral zone by an unusually deep raphe.

The range of *M. sphenorhynchus* also lies to the south, but its pattern is more advanced. This species has shields with five body annuli involved in their formation. Each of the shields narrows anteriorly; from being parallel their sutures become angled. Could this reflect fusion of the prepectoral annulus? Do they interdigitate with the segments of the preceding annulus?

In the western Zaire form *M. vanderysti* these

prepectoral segments have become further enlarged and "captured" by the pectoral shield which generally corresponds to four body annuli. They are contiguous with this rather than being separated off by an expansion groove (of the type seen between the more anterior gular annuli). The posterior edges of the segments interdigitate with the regular pectoral shields providing an anterior zone of shorter and a posterior zone of longer ones.

Farther east and south we encounter *M. scalper, D. welwitschii,* and other *Dalophia.* In these the longitudinal shields are not only narrowed anteriorly, but a second set of enlarged, much smaller, and posteriorly narrowing shields interdigitates anteriorly. This forms an arrangement of generally radial sutures. There is also a lateral lengthening of the dorsal half-annuli corresponding to the modified pectoral zone.

The species *M. schoutedeni, M. guentheri,* and *M. galeata,* all from north of the Zaire (Congo) River, show a gradual narrowing and widening of the shields along the anterior end. In *M. jugularis* the trend has come to its logical conclusion with the almost square pectoral shield zone. The intersegmental raphes curve (and cross), turning from the left posterior edge to terminate on the right anterolateral edge, and from the right posterior to the left anterolateral edges. The posteriormost segments are then almost rectangular, whereas the anterior ones are parallelogrammic to irregularly quadrangular. These pectoral segments

are about twice the size of the more posterior ventral ones, but this arrangement is certainly quite distinct from that in more southern species.

The sequences suggest a rough geographical transition from south to north. There may well be some question regarding its reality. *Monopeltis schoutedeni*, *galeata*, *remaclei*, *adercae*, and *jugularis* are the largest species, and they also have the widest and most irregular pattern. The most defined pattern is seen in the forms of *Dalophia*, in *M. guentheri*, and in *M. sphenorhynchus*. Except for *M. zambezensis* these have the least body diameter. Do the species with a smaller body diameter incur greater selection for pectoral polish and elongation? [Note that the pectoral region just reaches the curving portion of the ventral surface when the animal is in extreme dorsiflexion.] The explanation of such observations should not be oversimplified. The situations in *M. capensis*, *M. anchietae*, *M. leonhardi*, *M. kabindae*, and even *M. sphenorhynchus* certainly represent a quantum jump from the situation seen in the species of *Dalophia* from the central portion of the range. We may well be dealing with three distinct influences on the pectoral pattern. One might be a geographical trend, another ecological and the last the effect of size.

Relative to the snout-vent length, body diameter and tail length increase allometrically in the Amphisbaenia. As the number of annuli and segments are fixed, their proportions change ontogenetically. This reduces the utility of interspecies discrimination by length-width ratio of the pectoral zone. It also suggests that the proportions of the pectoral region may not be under equal selection for each size, but may well be shaped for optimum effectiveness at one state when locomotor and predatory effectiveness may be at a premium. Such questions require sizable series and some experimental work on burrowing effectiveness at different ages.

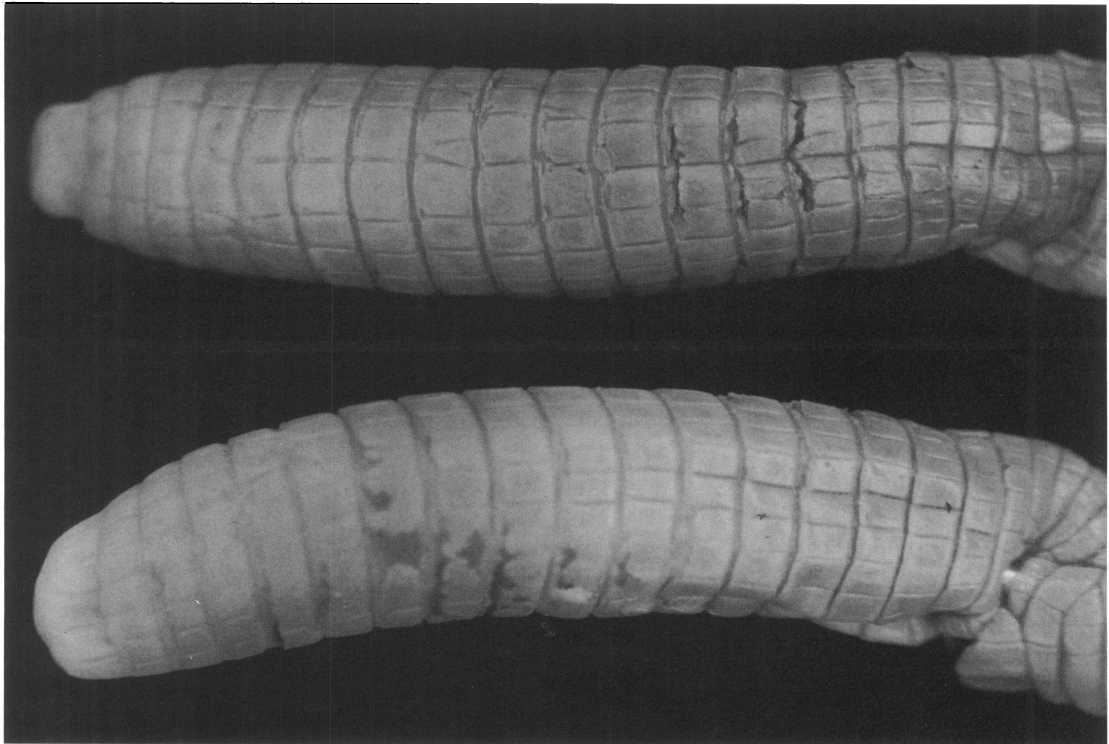Vanzolini (1951) suggested that fusion of

FIG. 140. *Dalophia luluae*. Dorsal and lateral view of tail of holotype RGMC 10848 from Sandoa, Zaire.

segments in amphisbaenians occurs in zones of wear. Thus the head shields are fused as the cephalic surface wears in soil penetration (see Gans, 1974). Do the pectoral fusions involve some similar aspect?

ECOLOGY

Most specimens of *Monopeltis* and *Dalophia* in collections were exposed by earthmoving equipment or plows, others were driven onto the surface by flooding (FitzSimons, 1943, p. 392) or attacks by carnivorous ants (Loveridge, 1920, p. 146). Unfortunately none of these operations gives a clear picture of the burrow system used by the animals.

One of Visser's collectors estimated the density of *Monopeltis capensis* in the Odendaalrus area at 50 specimens to the hectare in virgin ground. They are plowed up at a depth of approximately 20 cm. After the land has been plowed for a few years the amphisbaenians disappear but the collector is not sure whether this is a result of the casualties of plowing or because of the artificial fertilizer. Many of the amphisbaenians that are not killed by the plow are seized by ravens and other birds following it. At Stella, Vryburg District, a collector found *M. capensis* common in "rooi leeugrond" (red lion sand) when plowed for the first time, but they become less common after a few years of cultivation. He estimated that 90 percent of the amphisbaenians exposed were cut in two by the plow. At Vetfontein, Waterpoort District, *M. sphenorhynchus* occurred in red sand, but *Zygaspis quadrifrons* was found by Visser in white sand near dry watercourses.

Following good rains in the Kalahari at the beginning of 1967, Broadley obtained a variety of amphisbaenians from plowing at three localities. On January 20, after heavy rain the previous night, a plow was seen working 40 km. west of Ghanzi. Twenty minutes spent following the plow yielded a *Monopeltis anchietae* and two *M. capensis* from red sandy soil which had been under cultivation for some time.

At Kangyane Pan on February 5, a plow was found in a derelict village and was drawn by a truck following an erratic course through virgin bush. This yielded four *Monopeltis leonhardi.* Two days earlier, heavy rain had flooded an area

at the edge of the pan: four *M. leonhardi* were found drowned and a fifth was recovered from the crop of a scavenging yellow-billed kite (*Milvus aegyptius*).

At Mabua Sehubi Pan on February 12, random plowing produced a mixed bag of four *Monopeltis capensis*, two *M. sphenorhynchus mauricei*, and two *Dalophia pistillum*. No *Zygaspis quadrifrons* were plowed up; this species was usually found under litter beneath large *Acacia* trees, where there was termite activity.

At Bokspits on the Molopo River we plowed a furrow along the river bed, up through the white sand dunes into the red dunes, but no amphisbaenians were found.

Collecting amphisbaenians by hand is usually a back-breaking business with little reward. It can be profitable after the first heavy rain of the season, as at Malugwe Pan in southeastern Rhodesia in December, 1966. A large *Monopeltis leonhardi* and three *M. capensis* (one in the stomach of a snake *Xenocalamus bicolor lineatus*) were obtained by Broadley when digging shallowly beneath logs that were being eaten by termites; two more *M. capensis* were found near the surface on the periphery of a small termitarium.

The largest specimen of *M. s. sphenorhynchus* was also obtained near the surface at the edge of a small termitarium at Mapinhane on the Mozambique coastal plain; again it had recently been swallowed by *Xenocalamus bicolor lineatus.*

In Wankie District early in 1961, Broadley turned many logs and captured a few *Zygaspis quadrifrons*, a young *Monopeltis leonhardi*, and a *Dalophia pistillum.*

A borrow pit was excavated by bulldozer and scrapers on April 17, 1961, at Lukosi River Bridge near Wankie. About 40 cm. of Kalahari sand over decomposed paragneiss was removed over an area of approximately 2500 sq. m. and 41 specimens of *Monopeltis capensis* were recovered, all within 30 cm. of the surface. The moisture content of the sand was 5 percent, i.e., close to optimum for compaction purposes.

On April 21, 1961, a bulldozer removed the grass and 2 or 3 cm. of topsoil from a strip about half a km. long and 10 m. wide during the realignment of Dett crossroads, Wankie District. Nine *Dalophia pistillum* were recovered in very

superficial burrows; in this area there was only 15 cm. of rather coarse sand substrate derived from paragneiss.

Many specimens of *Monopeltis capensis* were unearthed by a bulldozer cutting a firebreak along the northeastern boundary of the Kruger National Park (Pienaar, 1966, p. 99).

A specimen of *M. anchietae* was found in moist loamy soil under a stone at the foot of the Waterberg, South West Africa (FitzSimons, 1938, p. 194). A specimen of *M. leonhardi* was found while excavating gerbil burrows in Kalahari sandveld at Gomodimo Pan (FitzSimons, 1935, p. 354).

A specimen of *Dalophia pistillum* from Dekar left tracks in the sand which led to a tuft of grasses, from beneath which it was dug up at a depth of 20-30 cm.

ECOLOGICAL MEANING OF SPECIES' SYMPATRY

Monopeltis anchietae tends to inhabit moister habitats than the other species of *Monopeltis*, although it is sympatric with *M. capensis* at some localities in the western part of its range, with *M. leonhardi* in the southern part of its range and with *M. sphenorhynchus mauricei* in the eastern part of its range.

Monopeltis leonhardi is typical of the Kalahari sand, sharing this habitat with *M. sphenorhynchus mauricei*. It is sympatric with *M. capensis* and/or *M. anchietae* in the western part of its range and it is also sympatric with *M. capensis* in southeastern Rhodesia (Malugwe Pan).

Monopeltis capensis is the most widespread species and is sympatric with all southern species except *M. zambezensis* somewhere or other. One gets the impression that it tolerates harder substrates than the other species; this is particularly striking in Wankie District, where *M. leonhardi* and *M. s. mauricei* inhabit the Kalahari sand areas in the National Park, but are replaced by *M. capensis* in the sandstone areas around the Wankie collieries.

Monopeltis zambezensis is poorly known, but four of the paratypes were dug up 5 to 15 cm. below the surface in red soil on an island in Lake Kariba. This suggests that the species does not require the sandy soils needed by other species of *Monopeltis*.

Monopeltis sphenorhynchus seems to require deep sand—either Kalahari sand or coastal alluvium.

Dalophia pistillum is by far the most widespread species of *Dalophia*, and seems to be rather tolerant in its habitat requirements. It inhabits the deep Kalahari sand and the coastal alluvium in Mozambique. but is widespread on harder substrates of the Zambezi Valley and its southern escarpment. Consequently, its absence from the Limpopo basin is rather puzzling, particularly as there is one record from the Waterberg District in the northern Transvaal.

Dalophia longicauda is largely parapatric with *D. pistillum*, but most of the recorded specimens were taken close to large permanent rivers, so perhaps it needs moist substrates.

The other long-tailed species, *D. ellenbergeri*, is only known from the upper Zambezi flood plain and perhaps requires moist substrates. Apparently the *Dalophia* congregate on large termitaria that protrude above floodwaters of the Zambezi (C. R. Owen, personal commun.). In this area there appears to be character displacement between this extremely attenuated species and the sympatric populations of *D. pistillum*, which attains a greater size than elsewhere in its range.

PREDATORS

It has been shown that the snakes of the genus *Xenocalamus* prey almost entirely on amphisbaenians of the genera *Monopeltis* and *Dalophia* (Broadley, 1971b).

Monopeltis capensis has been found in the stomachs of the following forms: *Xenocalamus sabiensis* in the Sabi Valley of Rhodesia (Birchenough Bridge and Humani Ranch); *X. bicolor lineatus* in the Gonarezhou Game Reserve, southeastern Rhodesia (Malugwe Pan and Mabalauta) and *X. bicolor australis* in the northern Transvaal (Vygeboom).

Monopeltis sphenorhynchus sphenorhynchus has been recovered from the stomachs of *Xenocalamus bicolor lineatus* in southern Mozambique (Mapinhane and Chimonzo), whereas a *M. s. mauricei* has been found in the stomach of a *Xenocalamus mechowi inornatus* in the eastern Caprivi.

The diet of the large species *Xenocalamus*

michelli is unknown, but it is recorded from Bukena, Zaire, where *Monopeltis scalper* and *M. adercae* are sympatric, so both these species are probably preyed upon.

Dalophia pistillum has been recovered from the stomach of a *Xenocalamus mechowii mechowii* × *inornatus* at Kabompo Boma and a *X. mechowii inornatus* at Kalabo, Zambia, whereas *D. longicauda* has been recovered from stomachs of several *X. mechowii inornatus* in the eastern Caprivi and at Victoria Falls.

The only Zambian specimen of *Dalophia angolensis* was recovered from the stomach of a *Xenocalamus mechowii mechowii* × *inornatus* on the Zambezi River.

Other snake species do not seem to take many large amphisbaenians, although various species of *Amblyodipsas* and *Atractaspis* are likely predators. The only non-*Xenocalamus* snake predator recorded is a *Rhamphiophis acutus jappi*, which had swallowed a *Dalophia ellenbergeri* at Kalabo, Zambia (Broadley, 1971c).

Small carnivores prey upon amphisbaenians, either catching them on the surface at night or digging them up. The following cases of predation have been recorded:

Monopeltis leonhardi in the stomach of a Black-backed jackal (*Canis mesomelas*) in Kalahari Gemsbok National Park.

Dalophia pistillum in the stomach of a ratel (*Mellivora capensis*) at Boshu Boholu Pan, Botswana. An unidentified *Dalophia* was found in the stomach of a ratel at Lóvua, Angola (Laurent, 1964, p. 87).

Dalophia pistillum in the stomach of a polecat (*Ictonyx striatus*) at Tsau, Botswana.

Most records of *Monopeltis* taken by birds are probably cases of the amphisbaenians being scavenged after they had been drowned or forced out of their burrows by predatory ants. The following instances have been recorded:

Monopeltis leonhardi in the crop of a yellow-billed kite (*Milvus aegyptius*) at Kangyane Pan, Botswana (following local flooding).

Monopeltis capensis (two) on nest of yellow-billed kite at Buhera, Rhodesia.

Monopeltis capensis (four) in crop of bateleur (*Terathopius ecaudatus*) on the Save River, Mozambique.

Monopeltis capensis recovered from a red-billed hornbill (*Lophoceros erythrorhynchus*) at Humani Ranch, Rhodesia.

Dalophia angolensis captured by a domestic fowl at Alto Cuilo, Angola (Laurent, 1964:87).

BREEDING

Monopeltis capensis is ovoviviparous; eight females from Maquassi, SW Transvaal, contained 1-3 embryos (usually one) in December. A newborn young measured 92+7 mm.; it was expelled on January 31, after its mother had been damaged by a plowshare (Visser, 1967).

Dalophia seems to be an oviparous genus. A *D. ellenbergeri* from Lukona, Zambia (FMNH 134555) contains two eggs measuring 30 × 5 mm. Loveridge (1920, p. 146) found four eggs in each of two female *D. pistillum* taken at Lumbo, Mozambique, at the end of August; a third female laid four eggs on September 20. Their measurements varied from 26 by 9 to 35 by 8 mm.

DIET

Very few data on the diet of *Monopeltis* and *Dalophia* can be found in the literature, so the stomach contents of small samples of those species that are well represented in the Umtali Museum collection were analyzed and sent to various specialists for examination, yielding the following data.

Monopeltis anchietae: Two specimens from Khwai, Moremi Game Reserve, Botswana, contained: Isoptera—*Odontotermes* sp. (*ca.* 50 workers); Coleoptera—Scarabaeidae (adult Melolonthinae); Lepidoptera (larvae and pupae).

Monopeltis leonhardi: A specimen from Kangyane Pan, Botswana, contained: Isoptera—*Hodotermes mossambicus* (six workers); Coleoptera—Tenebrionidae (larva).

Five specimens from Wankie National Park, Rhodesia, contained: Isoptera—*Odontotermes* sp. (eight soldiers, circa 80 workers); Coleoptera—Tenebrionidae (larva); Diplopoda (segments of 1 mm. diam. millipede).

The specimen from Malugwe Pan, Gonarezhou, Rhodesia, contained: Isoptera—

Odontotermes sp. (two soldiers, 40 workers); Coleoptera—Tenebrionidae (larva).

Monopeltis capensis: Stomach contents of 100 specimens from Nyashanu, Buhera District, Rhodesia contained remains of the following insects: Isoptera—*Odontotermes* sp. (several hundred soldiers and workers), *Allodontermes* sp. (six soldiers and workers, six alates), *Microtermes* sp. (one soldier, few workers, six alates), *Macrotermes* sp. (major soldier, two workers); Coleoptera—Curculionidae (adults), Tenebrionidae (larva), Scarabaeidae (legs of Melolonthinae); Hymenoptera (head fragments of ? *Camponotus*). There were also the remains of two solifuges (probably *Solpuga* sp. and *Biton* sp.).

No study of feeding habits has been attempted. Visser has had no difficulty in keeping this species alive on a diet of termite workers, and Broadley and Gans have fed the same species on termite workers, crickets, mealworms and the larvae of fossorial beetles.

Monopeltis sphenorhynchus mauricei: Four specimens from Moremi Game Reserve, Botswana, contained: Hymenoptera (remains of Formicidae); Lepidoptera (larva).

Four specimens from 65 km. WSW of Katima Mulilo, Caprivi Strip, S.W.A., contained: Isoptera—*Odontotermes* sp. (one soldier, 50 workers); Coleoptera (fragments of adults).

Three specimens from Ngoma, Kafue National Park, Zambia, contained: Coleoptera (mandible of beetle); Hymenoptera (head fragments of Formicidae).

A *Dalophia pistillum* from Caia, Mozambique,

contained remnants of coprophagous or ligni-phagous beetle larvae (Cott, 1934, p. 158).

Two Transvaal Museum specimens from Labora Farm, Gobabis, South West Africa, contained: Isoptera—*Hodotermes mossambicus* (two workers) and two small unidentified alates.

Three specimens from Moremi Game Reserve, Botswana, contained: Coleoptera—Scarabaeidae (adults of Melolonthinae; larvae); Hymenoptera—Formicidae (cocoons and pupae of *Camponotus* sp.).

Three specimens from Chizarira Game Reserve, Rhodesia, contained: Isoptera—*Allodontermes* sp. (seven soldiers, *ca.* 70 workers); Coleoptera—Scarabaeidae (several adults of Melolonthinae).

Dalophia longicauda: Six specimens from 15 km. WSW of Katima Mulilo, Caprivi Strip, S.W.A., contained: Coleoptera—Scarabaeidae (larvae), Tenebrionidae (larvae); Hymenoptera—Formicidae (larvae and cocoons of *Camponotus* sp.).

All species of *Monopeltis* and *Dalophia* prey upon the fungus-growing termites (Macrotermitinae) and to a lesser extent on harvester termites (Hodotermitinae). A variety of beetles (adults and larvae) are taken, with the families Scarabaeidae and Tenebrionidae predominating. A few lepidopterous larvae and pupae are taken and also a few ants (adults, larvae, cocoons, and pupae mainly of *Camponotus*). It would seem that species of *Monopeltis* take more termites than do those of *Dalophia*; the latter prey more heavily on beetles and their larvae.

LITERATURE CITED

Alexander, A. Allen, and Carl Gans
1966. The pattern of dermal-vertebral correlation in snakes and amphisbaenids. Zool. Meddel., Leiden, vol. 41, no. 11, pp. 171-190.

Angel, Fernand
1920. Liste de reptiles du Haut-Zambèze et de l'Afrique australe. Description d'une espèce nouvelle du genre *Monopeltis*. Bull. Mus. Natl. d'Hist. Nat., Paris, vol. 26, no. 7, pp. 614-617.

Baird, Irwin L.
1970. The anatomy of the reptilian ear. *In* Gans, C. and T. S. Parsons, eds.,

Biology of the Reptilia. London, Academic Press, vol. 2, chapt. 3, pp. 193-275.

Barbour, Thomas, and Arthur Loveridge
1929. Typical reptiles and amphibians. Bull. Mus. Comp. Zool., vol. 69, no. 10, pp. 205-360.

Bocage, J. V. Barbosa du
1873a. Melanges érpétologiques II. Sur quelques reptiles et batraciens nouveaux, rares ou peu connus d'Afrique occidentale. Jor. Sci. Lisbõa, vol. 4, pp. 209-227.
1873b. Reptiles nouveaux de l'interieur de

Mossamedes. *Ibid.*, vol. 4, pp. 247-253.

1895. Herpetologie d'Angola et du Congo. Lisbon, xx+203 pp.

1896. Reptis de algumas possessões portuguezas d'Afrique existem no Museu de Lisboa. Jor. Sci. Lisbõa, vol. 2, no. 4, pp. 65-104.

1897. Mammiferos, reptis e batrachios d'Afrique de que existem exemplares typicos no Museu de Lisbõa. *Ibid.*, vol. 2, no. 16, pp. 187-211.

Boettger, Oskar
1895. Zwei neue Reptilien vom Sambesi. Zool. Anz., vol. 18, pp. 62-63.

Boulenger, George Albert
1885. Catalogue of the lizards in the British Museum (Natural History). Second edition. London, vol. 2, xiii+497 pp.

1891. On the state of our knowledge of the reptiles and batrachians of British Central Africa. Proc. Zool. Soc. London, pp. 305-309.

1907. Second report on the batrachians and reptiles collected in South Africa by Mr. C. H. B. Grant, and presented to the British Museum by Mr. C. D. Rudd. *Ibid.*, pp. 478-487.

1910. A revised list of the South African reptiles and batrachians, with synoptic tables, special reference to the specimens in the South African Museum, and descriptions of new species. Ann. South African Mus., vol. 5, pp. 455-538.

1913. Description d'une reptile amphisbenide nouveau provenant du Katanga. Rev. Zool. Africaine, Brussels, vol. 2, pp. 392-393.

Broadley, Donald G.
1962. On some reptile collections from the north-western and north-eastern districts of Southern Rhodesia 1958-1961, with descriptions of four new lizards. Occas. Papers Natl. Mus. Southern Rhodesia, vol. 4, no. 26B, pp. 787-843.

1971a. The reptiles and amphibians of Zambia. The Puku, Occas. Papers Dept. of Wildlife, Fish. and Natl. Parks, Zambia, no. 6, pp. 1-143.

1971b. A revision of the African snake genera *Amblyodipsas* and *Xenocalamus*. Occas. Papers Natl. Mus. Rhodesia, vol. 4, no. 33B, pp. 629-697.

1971c. A review of *Rhamphiophis acutus* (Günther) with the description of a new subspecies from Zambia (Serpentes:

Colubridae). Arnoldia, Rhodesia, vol. 5, no. 8, pp. 1-8.

Broadley, Donald G., and Carl Gans
1969. A new species of *Zygaspis* (Amphisbaenia: Reptilia) from Zambia and Angola. Arnoldia, Rhodesia, vol. 4, no. 25, pp. 1-4.

Chubb, E. C.
1909. List of Rhodesian batrachians and reptiles in the Rhodesia Museum Collection. Rhodesia Mus. Bulawayo, 8th Ann. Rept., pp. 34-36.

Cott, Hugh
1934. The Zoological Society's expedition to the Zambesi, 1927. No. 5. On a collection of lizards, mainly from Portuguese East Africa, with descriptions of new species of *Zonurus*, *Monopeltis* and *Chirindia*. Proc. Zool. Soc. London, pp. 145-173.

FitzSimons, Vivian F. M.
1932. Preliminary descriptions of new forms of South African Reptilia and Amphibia, from the Vernay-Lang Kalahari Expedition, 1930. Ann. Transvaal Mus., vol. 15, no. 1, pp. 35-40.

1933. Description of five new lizards from the Transvaal and Southern Rhodesia. *Ibid.*, vol. 15, no. 2, pp. 273-280.

1935. Scientific results of the Vernay-Lang expedition, March to September, 1930. Reptilia and amphibia. *Ibid.*, vol. 16, no. 2, pp. 295-397.

1937a. Notes on the reptiles and amphibians collected and described from South Africa by Andrew Smith. *Ibid.*, vol. 17, no. 4, pp. 259-274.

1937b. Three new lizards from South Africa. *Ibid.*, vol. 17, no. 4, pp. 275-279.

1938. Transvaal Museum expedition to South-West Africa and Little Namaqualand, May to August, 1937. Reptiles and amphibians. *Ibid.*, vol. 19, no. 2, pp. 153-209.

1941. Description of some new lizards from South Africa and a frog from Southern Rhodesia. *Ibid.*, vol. 20, no. 3, pp. 273-281.

1943. The lizards of South Africa. Transvaal Mus. Mem., no. 1, xv+528 pp.

1956. Reptiles and amphibians of the Wonderboom Nature Reserve. Fauna & Flora (Pretoria), no. 7, pp. 89-99.

FitzSimons, Vivian F. M., and C. K. Brain
1958. A short account of the reptiles of the

Kalahari Gemsbok National Park. Koedoe, vol. 1, no. 1, pp. 99-104.

Fox, Wade
1948. Effect of temperature on development of scutellation in the Garter Snake, *Thamnophis elegans atratus.* Copeia no. 4, pp. 252-262.

Fürbringer, Maximilian
1900. Zur vergleichenden Anatomie des Brustschulterapparates und der Schultermuskeln. Jena. Zeitschr. Naturwiss., vol. 34, pp. 215-718(597-718). Last part published separately and titled: Beitrag zur Systematik und Genealogie der Reptilien.

Gans, Carl
1960. Studies on amphisbaenids (Amphisbaenia, Reptilia). 1. A taxonomic revision of the Trogonophinae, and a functional interpretation of the amphisbaenid adaptive pattern. Bull. Amer. Mus. Nat. Hist., vol. 119, no. 3, pp. 129-204.
1966. Studies on amphisbaenids (Amphisbaenia, Reptilia), 3. The small species from southern South America commonly identified as *Amphisbaena darwini. Ibid.,* vol. 134, no. 3, pp. 185-260.
1967. A check list of Recent amphisbaenians (Amphisbaenia, Reptilia). *Ibid.,* vol. 135, no. 2, pp. 61-106.
1971. Studies on amphisbaenids. 4. A review of the amphisbaenid genus *Leposternon. Ibid.,* vol. 144, no. 6, pp. 379-464.
1974. Biomechanics: Approach to vertebrate biology. Philadelphia, J. P. Lippincott, x+261 pp.
1976. Three new spade-snouted amphisbaenians from Angola (Amphisbaenia, Reptilia). Amer. Mus. Novitates no. 2590, pp. 1-11.

Gans, Carl, and A. Allen Alexander
1962. Studies on amphisbaenids (Amphisbaenia, Reptilia). 2. On the amphisbaenids of the Antilles. Bull. Mus. Comp. Zool., vol. 128, no. 3, pp. 65-158.

Gans, Carl, and Donald G. Broadley
1974. A new dwarfed species of *Monopeltis* from the middle Zambezi Valley (Reptilia: Amphisbaenia). Arnoldia Rhodesia, vol. 6, no. 35, pp. 1-5.

Gans, Carl, and Mahmood Latifi
1971. Redescription and geographic variation

of *Monopeltis guentheri* Boulenger (Amphisbaenia, Reptilia). Amer. Mus. Novitates, no. 2464, pp. 1-21.

Gans, Carl, and Grace C. Lehman
1973. Studies on amphisbaenians (Amphisbaenia: Reptilia). 5. The species of *Monopeltis* from north of the river Zaire. Occas. Papers Mus. Zool., Univ. Mich., no. 669, pp. 1-34.

Gans, Carl, and Ernest Glen Wever
1972. The ear and hearing in Amphisbaenia (Reptilia). Jour. Exper. Zool., vol. 179, no. 1, pp. 17-34.

Gray, John Edward
1865. A revision of the genera and species of amphisbaenians with the descriptions of some new species now in the collection of the British Museum. Proc. Zool. Soc. London, pp. 442-455.
1872. Catalogue of shield reptiles in the collection of the British Museum. Part II. Emydosaurians, rhynchocephalians, and amphisbaenians. London, vi+41 pp.
1873. Handlist of the specimens of the shield reptiles in the British Museum. London, iv+124 pp.

Günther, Carl Albert Ludwig Gotthilf
1876. Notes on a small collection brought by Lieut. L. Cameron, C. B., from Angola. Proc. Zool. Soc. London, pp. 678-679.

Hallowell, Edward
1852. Description of new species of Reptilia from western Africa. Proc. Acad. Nat. Sci. Philadelphia, vol. 6, pp. 62-65.

Hewitt, John, and J. H. Power
1913. A list of South African Lacertilia, Ophidia and Batrachia in the McGregor Museum, Kimberley; with field notes on various species. Trans. Roy. Soc. South Africa, vol. 3, pp. 147-176.

Hill, John Eric, and T. Donald Carter
1941. The mammals of Angola, Africa. Bull. Amer. Mus. Nat. Hist., vol. 78, no. 1, pp. 1-211.

Hoffstetter, Robert, and Jean-Pierre Gasc
1969 Vertebrae and ribs of modern reptiles. *In* Gans, C., A. d'A. Bellairs and T. S. Parsons, eds., Biology of the Reptilia. London, Academic Press, vol. 1, no. 5, pp. 201-310.

Huang, C. C., and Carl Gans
1971. The chromosomes of 14 species of amphisbaenians (Amphisbaenia, Reptilia). Cytogenetics, vol. 10, pp. 10-22.

Jollie, Malcolm T.
1960. The head skeleton of the lizard. Acta Zoologica, vol. 41, no. 1-2, pp. 1-64.

Kritzinger, C. C.
1946. The cranial anatomy and kinesis of the South African amphisbaenid *Monopeltis capensis* Smith. South African Jour. Sci., Cape Town, vol. 42, pp. 175-204.

Kirby, Percival R.
1965. Sir Andrew Smith M.D., K. C. B. His life, letters and works. A. A. Balkema: Cape Town, Amsterdam, ix+358 pp.

Laurent, Raymond F.
1947. Note sur les Amphisbaenidae d'Afrique. Rev. Zool. Bot. Africaine, vol. 40, no. 1, pp. 52-63.
1952. Batraciens et reptiles récemment acquis par le Musée du Congo Belge. *Ibid.*, vol. 45, no. 3-4, pp. 198-203.
1953. Reptiles et batraciens récemment parvenus au Musée royal du Congo Belge. Bull. Cercle Zool. Congolais, vol. 21, no. 1, pp. 21-29.
1954. Reptiles et batraciens de la région de Dundo (Angola) (Deuxieme note). Publ. Cult. Cia Diamant Angola, no. 23, pp. 35-84.
1955. Un lézard qui n'en est plus un. (*Monopeltis adercai*). Congo-Tervuren, vol. 1, no. 4, pp. 142-143.
1956. Notes herpetologiques africaines. Rev. Zool. Bot. Africaine, vol. 52, nos. 3-4, pp. 229-256.
1964. Reptiles et amphibiens de l'Angola. (Troisième contribution). Publ. Cult. Cia Diamant Angola, no. 67, pp. 1-165.

Lichtenstein, Martin H. C.
1856. Nomenclator reptilium et amphibiorum Musei Zoologici Berolinensis. Berlin, iv+48 pp.

Loveridge, Arthur
1920. Notes on East African lizards collected 1915-1919, with description of a new genus and species of skink and a new subspecies of gecko. Proc. Zool. Soc. London, pp. 131-167.
1941. Revision of the African lizards of the family Amphisbaenidae. Bull. Mus. Comp. Zool., vol. 87, no. 5, pp. 353-451.
1953. Reptiles from Nyasaland and Tete. *Ibid.*, vol. 110, pp. 143-322.

Malan, M. Elsabe
1946. Contributions to the comparative anatomy of the nasal capsule and the organ of Jacobson of the Lacertilia. Ann. Univ. Stellenbosch, vol. 24, no. Z, pp. 69-137.

Manaças, Sara
1956. Contribucão para o estudo dos reptéis (Saurios e Leptotiflopideos) de Moçambique. Anais Junta Invest. Ultramar, vol. 9, no. 3, pp. 1-8.

Marx, Hymen
1958. Catalogue of type specimens of reptiles and amphibians in the Chicago Natural History Museum. Fieldiana, vol. 36, no. 4, pp. 409-496.

Mayr, Ernst
1946. The naturalist in Leidy's time and today. Proc. Acad. Nat. Sci. Philadelphia, vol. 98, pp. 271-276.

Mertens, Robert
922. Verzeichniss der Typen in der herpetologischen Sammlung des Senchenbergischen Museums. Senckenbergiana, vol. 4, no. 6, pp. 162-183.
1955. Die Amphibien und Reptilien Südwestafrikas. Aus den Ergebnissen einer im Jahre 1952 ausgeführten Reise. Abhandl. Senckenbergischen naturf. Gesell. Frankfurt a.M., vol. 490, pp. 1-170.
1967. Die herpetologische Sektion des Natur-Museums und Forschungs-Institutes, Senckenberg in Frankfurt a. M. nebst einem Verzeichnis ihrer Typen. Senckenbergiana Biol., vol. 48, Suppl.1.A pp. 1-106.
1971. Die Herpetofauna Südwest-Afrikas. Abhandl. Senckenbergischen naturf. Gesell. Frankfurt a. M., vol. 529, pp. 1-110.

Merwe, N. J. van der
1940. Die liggaamsvate van *Monopeltis capensis* Smith Sp. Tydskrif vir Wetenskap en Kuns, vol. 1, no. 2, pp. 201-207.

Monard, Albert
1931. Mission scientifique Suisse dans l'Angola. Résultats scientifiques. Reptiles. Bull. Soc. Neuchâtel. Sci. Nat., vol. 55, pp. 89-111.
1937. Contribution à l'herpétologie d'Angola. Arq. Mus. Bocage, Lisbon, vol. 8, pp. 19-153.

Nieden, Fritz
1913. Herpetologisches Neues aus Deutsch-Südwestafrika. Sitzungsberichte Gesell. naturf. Freunde Berlin, pp. 449-452.

Parker, Hampton W.
1935. A new species of amphisbaenid lizard from Bechuanaland. Ann. Mag. Nat. Hist., ser. 10, vol. 15, pp. 582-583.

1936. Dr. Karl Jordan's expedition to South-West Africa and Angola. Herpetological collections. Novit. Zool., vol. 40, pp. 115-146.

Parsons, Thomas S.
1970. The nose and Jacobson's organ. *In* Gans, C. and T. S. Parsons, eds., Biology of the Reptilia. London, Academic Press, vol. 2, no. 2, pp. 99-191.

Peracca, Mario G.
1903. Descrizione di una nuova specie del genere *Monopeltis* Smith, del Congo. Bull. Mus. Zool. Anat. Comp. Torino, vol. 18, no. 448, pp. 1-3.
1910. Rettili raccolti nell'Alto Zambese (Barotseland) dal Signor Cav. Luigi Jalla. *Ibid.*, vol. 25, no. 624, pp. 1-6.

Peters, Wilhelm C. H.
1854. Diagnosen neuer Batrachier welche zusammen mit der früher (24 Juli und 17 August) gegebenen Übersicht der Schlangen und Eidechsen mitgetheilt werden. Monatsber. Akad. Wiss. Berlin, pp. 614-628.
1855. Uebersicht der auf seiner Reise gesammelten Amphibien. Arch. Naturg., vol. 21, no. 1, pp. 49-58.
1867. Über eine Sammlung von Flederthieren und Amphibien aus Otjimbingue in Südwestafrika, welche Hr. Missionär Hahn dem zoologischen Museum zugesandt hat. Monatsber. Akad. Wiss. Berlin, pp. 234-237.
1869. Förteckning på de af J. Wahlberg i Damaralandet insamlade Reptilierna. Ofvers. Kongl. Vetensk. Akad. Forhandl. Stockholm, pp. 657-662.
1879. Über die Amphisbaenen und eine zu denselben gehörige neue Art (*Lepidosternon Wuchereri*). Monatsber. Akad. Wiss. Berlin, pp. 273-277.
1882. Naturwissenschaftliche Reise nach Mossambique . . . Zoologie III. Amphibien. Berlin, xv+196 pp.

Pienaar, Uys de Villiers
1966. The reptiles of the Kruger National Park. Natl. Parks Board, South Africa, 223 pp.

Pitman, Charles R. S.
1934. A check list of reptilia and amphibia occurring and believed to occur in Northern Rhodesia. *In* Pitman, Report on a faunal survey of Northern Rhodesia. Livingstone, pp. 292-312.

Pratt, C. W. McE.
1948. The morphology of the ethmoidal region of *Sphenodon* and lizards. Proc. Zool. Soc. London, vol. 118, pp. 171-201.

Simonetta, Alberto Mario
1960. Distribuzione e significato dell'organo paratimpanico del Vitali. Atti. Soc. Tosc. Sciencze Naturali, ser. B, vol. 66, pp. 39-55.

Smith, Andrew
1834-1849. Illustrations of the Zoology of South Africa. London, pp. 1-28, pls. 1-78. [See Waterhouse, 1880, for exact dates of publication.]

Stanley, Henry M.
1879. Through the Dark Continent or the sources of the Nile around the Great Lakes of Equatorial Africa and down the Livingston River to the Atlantic Ocean. N.Y., Harper and Row, 2 vols., xiv+522 pp., ix+566 pp.

Sternfeld, Richard
1911a. Zur Herpetologie Südwestafrikas. Mitt. Zool. Mus. Berlin, vol. 5, pp. 393-411.
1911b. Die Reptilien (ausser den Schlangen) und Amphibien von Deutsch-Südwestafrika. Fauna deutscher Kolonien, Berlin, vol. 4, no. 2, pp. i-iv, 1-65.

Strauch, Alexandre
1881. Bemerkungen über die Eidechsenfamilie der Amphisbaeniden. Mélanges Biol. Acad. Imp. Sci. St. Pétérsbourg, vol. 11, pp. 355-479.

Stoll, N. R., and Others (Eds.)
1961. International Code of Zoological Nomenclature adopted by the XV International Congress of Zoology. London, xviii+176 pp.

Vanzolini, Paulo E.
1951. Evolution, adaptation and distribution of the amphisbaenid lizards (Sauria: Amphisbaenidae). Thesis, Harvard Univ., 148 pp.
1968. Environmental temperature and number of body annuli in *Amphisbaena alba*: Notes on a cline (Sauria, Amphisbaenidae). Papéis Avulsos Zool. São Paulo, vol. 21, no. 23, pp. 231-241.

Visser, John
1967. First report of ovoviviparity in a Southern African amphisbaenid, *Monopeltis c. capensis*. Zool. Africana, vol. 3, no. 1, pp. 111-113.

Wellington, John H.
1955. Southern Africa—a geographical study. Vol. I. Physical geography. Cambridge Univ. Press, xxiii+528 pp.

Werner, Franz

1910a. Reptilia et Amphibia. *In* Schultze, L. Zoologische und anthropologische Ergebnisse einer Forschungsreise im westlichen und zentralen Südafrika. Band IV, Vertebrata B. Denkschr. Med. Nat. Wiss. Gesell. Jena, vol. 16, pp. 279-370.

1910b. Über neue oder seltene Reptilien des naturhistorischen Museums in Hamburg. ii. Eidechsen. Hamburg Jahrb. Wiss. Anst., vol. 27(1909), suppl. no. 2, 1910, 1-46. *Reprinted*:1910, Mitteil. Naturhist. Mus. Hamburg, vol. 27.

1915. Reptilia und Amphibia. *In* Michaelsen, W., Beiträge zur Kenntnis der Land- und Süsswasser-fauna Deutsch Südwestafrikas III, pp. 325-376.

Wever, Ernest Glen, and Carl Gans

1973. The ear in Amphisbaenia (Reptilia); further anatomical observations. Jour. Zool., London, vol. 171, pp. 189-206.

Witte, Gaston-François de

1922. Description de reptiles nouveaux du Congo Belge. Rev. Zool. Africaine, vol. 10, no. 1, pp. 6-71.

1927. Un serpent rare du Kwango, Rev. Zool. Bot. Africaine, vol. 14, p. 104.

1933. Description de deux amphisbaenides nouveaux du Congo Belge. *Ibid.*, vol. 23, no. 2, pp. 168-171.

1953. Reptiles. Exploration du Parc National de L'Upemba. Mission G. F. de Witte. Inst. Parcs Natl. Congo Belge, Brussels, vol. 6, 322 pp.

1954. Revision des Amphisbaenidae du Congo Belge. Vol. Jubil. Victor von Straelen, Brussels, vol. 22, pp. 981-1010.

Witte, Gaston-François de, and Raymond F. Laurent

1942. Contribution á la systematique des Amphisbaenidae du Congo Belge. Rev. Zool. Bot. Africaine, vol. 36, no. 1, pp. 67-86.

Zangerl, Rainer

1944. Contributions to the osteology of the skull of the Amphisbaenidae. Amer. Mid. Natl., vol. 31, no. 2, pp. 417-454.

1945. Contributions to the osteology of the post-cranial skeleton of the Amphisbaenidae. *Ibid.*, vol. 33, no. 3, pp. 764-780.

APPENDIX

Gazetteer of localities with quarter degree grid coordinates.

SOUTH AFRICA		
CAPE PROVINCE		
Alhut	2820 D3	
Aughrabies Falls	2820 C2	
Barkly West	2824 D1	
Danielskuil	2823 B1	
Douglas	2923 B2	
Fort Richmond	2924 B1	
Hopetown	2924 C1	
Kakamas	2820 D3	
Kareeboom	2824 D2	
Kimberley	2824 D2	
Kimberley, 30 km. W of	2824 C2	
Modder River	2924 B1	
Noenieput	2720 C1	
Reitfontein, Gordonia	2620 C1	
Secretaris	2824 C2	
Tierkop, Nossob River	2520 D1	
Vroupan	2923 C2	
Vryberg	2624 D3	
ORANGE FREE STATE		
Bainsvlei	2926 A2	
Bloemfontein	2926 A1	
Bothaville	2726 B3	
Brandfort	2826 C2	
Glen	2826 C4	
Kelly's View	2926 A1	
Kroonstad	2727 C1	
Krugersdrift Dam	2825 D4	
Odendaalsrus	2726 D3	
Reitspruit	2926 A2	
Rhenosterspruit	2926 A2	
TRANSVAAL		
Andalusia	2724 D4	
Bezuidenhoutskraal	2528 A3	
Bloemhof	2725 D1	
Greefflaagte Farm, Lichtenburg	2626 A1	
Hope Farm, Waterberg	2428 A3	
Klipkuil Farm, Maquassi	2726 A3	
Kruger National Park:		
Hape Pan	2231 A4	
Hlanganine Firebreak	2331 C4	
Luvuvhu River		
(western boundary)	2231 A3	
Madzaringue Firebreak	2231 C1	
Mahlakuza Pan	2231 C2	

Malonga Fountain	2231 C2	Okahandja	2216 B2
Masbambela	2231 C4	Omaruru	2115 B4
Mutale River		Omatjenne	2016 B3
(western boundary)	2231 A3	Ombujomatemba	2017 C1
Nwambiya Pan	2231 C2	Ondongua	1716 D3
Nwambiyane Pan	2231 C2	Oshakati	1715 D3
Nyandu Sandveld	2231 C2	Otjarondyupa	
Olifants Camp	2331 D3	Otjimbingue	2216 A3
Olifants River—Mangwe Induna	2331 D1	Otjiwarongo	2016 B3
Pafuri	2231 A4	Otjosondu	2117 B4
Pumbe Sandveld	2431 B2	Otjosomgombe	2017 C3
Sesalondonga to Pafuri	2231 C2	Otjovasandu	1914 A4
Sesalondonga to Mahlakuza Pan	2231 C2	Ovikokorero	2117 C3
Western boundary north of		Outjo	2016 A2
Mutale River	2231 A3	Quickborn Farm, Otjiwarongo	2117 A1
Western boundary between		Rehoboth	2317 A3
Luvuvhu and Mutale rivers	2231 A3	Ruacana	1714 A3
Limpopo—Magalakwin Confluence	2228 B4	Rugby Farm	2117 A1
Limpopo—Nwanedzi Confluence	2230 B3	Runtu	1719 D4
Maquassi	2725 B4	Teufelsbach, Okahandja	2217 A1
Northam	2427 C4	Warmbad, Kaokoveld	1913 B2
Nylstroom	2428 C2	Waterberg	2017 A4
Philipstown Farm	2229 C4	Windhoek	2217 C1
Pretoria	2528 C3	Windhoek, 25 km. S of	2217 C3
Rechtuit	2427 D4		
Rhenosterpoort	2428 C4	*BOTSWANA*	
Rochdale Farm, Soutpansberg	2229 D3	Boshu Boholu Pan	2522 A3
Schildpadfontein	2428 D2	Dekar	2121 D2
Schweizer Reneke	2725 A2	Dikomu-di-Kai	2424 D3
Vygeboom	2428 C2	Francistown	2127 B1
Vygeboompoort	2428 C4	Ghanzi	2121 D2
Warmbaths	2428 C4	Ghanzi, 40 km. SW of	2121 C4
Waterpoort	2229 C3	Gomodimo Pan	2223 D1
Weipe Farm, Soutpansberg	2229 A2	Kang	2322 D2
Weltevreden, Middelberg District	2529 D1	Kangyane Pan	2322 C4
Wolmaransstad	2725 B2	Kaumaha	2024 B3
		Khwai	1923 B1
SOUTH WEST AFRICA		Kuke	2324 B3
Ababis	2316 C3	Khutse Game Reserve	2324 B4
Aub to Klein Nauas	2317 B4	Lekuru Pan	2422 C1
Bagani	1821 B1	Mabua Sefhubi Pan	2522 A1
Bethanien	2627 C1	Mabua Sefhubi Pan, 22 km. N of	2422 C3
Eava	2218 C1	Mahalapye	2326 B2
Etosha Pan Game Reserve		Maun	1923 C4
(border to Farm Onguma)	1817 C3	Maxwee, 15 km. S of	1923 B3
Gibeon	2517 B2	Monjalatsela, near Ghanzi	
Gobabis	2218 B4	Moremi Game Reserve	1923 B1
Gochegenas	2217 C3	Palapye Road	2227 C1
Gravelotte, Otjiwarongo Dist.	2117 A2	Shorobe	1923 D3
Grootfontein, Damaraland	1918 C1	Takatokwane Pan	2424 A1
Hoasas	2016 B3	Tamafupi	1924 A3
Katima Mulilo, Caprivi	1724 A3	Tamafupi, 35 km. N of	1924 A1
Katima Mulilo, 15 km WSW of	1724 C1	Tonoto	2127 A4
Katima Mulilo, 65 km WSW of	1723 D1	Tsau	2022 A2
Labora Farm, Gobabis Dist.	2119 B4	Tshabong, 30 km. NE of	2522 D3
Neitsas Farm, Grootfontein	1918 B3	Tshane, 40 km. S of	2421 B2

Boroma	1633 A2	Kabinda	0624 A2
Caia	1735 C4	Kahemba	0719 A3
Chimonzo	2433 C4	Kamina	0825 C3
Inhambane	2335 C4	Kanonga	0926 A3
Inhamitanga	1835 A1	Kikondja	0826 A2
Lourenço Marques (Delagoa Bay)	2532 D3	Kilembe (Kilemba)	0726 C1
Lumbo	1540 B1	Lac Leopold II (approx.)	0218 A2
Madureira		Leopoldville	0415 A4
Manhica	2532 B4	Leverville	0418 D3
Mapinhane	2235 A3	Lubue	0419 B2
Matchova	2232 B4	Lukulu, near Kiambi	0728 A3
Morera	2134 A3	Mabwe	0826 D1
		Manono	0727 A4
TANZANIA		Mayombe (approx.)	0513 A1
Sicumba		Munoi	0826 D3
		Ngada-Saint-Famille	
ZAIRE		Nyunzu	0528 C3
Bokoro	0218 C4	Popokabaka	0516 D1
Bukena	0726 D4	Sandoa	0922 D2
Ipamu	0419 B1	Sanga	0826 C4
Kabalo	0626 B2	Wombali	0317 A4