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A FOSSIL RIVER DOLPHIN FROM FLORIDA

By Glover M. Allen

With Three Plates

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No. 1 — *A Fossil River Dolphin from Florida*

By Glover M. Allen

In June of 1940 Professor Robert L. Nichols of Tufts College received a letter from Mr. Lewis H. Carter of the American Agricultural Chemical Company, stating that they were uncovering some vertebrate fossils in their Florida phosphate-rock mines. Curiously enough, these finds are not continuously made but occur at more or less haphazard and sometimes at quite widely separated periods of time.

Knowing that the Museum of Comparative Zoölogy was particularly interested in such material, he brought the letter to Dr. P. E. Raymond, who called it to the attention of Dr. Thomas Barbour. Through Dr. Nichols a letter of introduction to the superintendent of the American Agricultural Chemical Company's mines, Mr. H. L. Hudson, was very kindly given Dr. Barbour by Mr. Carter.

Owing to Dr. Barbour's subsequent illness he was unable to present this letter himself, but his associate, Dr. T. E. White, who was with him in Florida, received most courteous attention from Mr. Hudson, and through him introductions were given to the superintendents of other mines. Grateful acknowledgments are also due to Mr. W. N. Simpson, the company's engineer at Pierce. As a result of sundry visits to several mines in this area a number of extraordinarily interesting fossils from this productive early Pliocene locality have been acquired by the Museum, and one of these Dr. Barbour has entrusted to me to describe, as he suspected that it represented a new form.

The specimen proves to be of unusual interest as the first certain record of a cetacean of the family Iniidae from eastern North America. Elsewhere, according to Dr. Remington Kellogg's account in 1928, fossil iniids are known from "a few imperfectly preserved fragments of skulls of Miocene and early Pliocene age," from two formations in Argentina and from an upper Miocene station near Rodeo, California. While the two living genera of this family, *Inia* and *Lipotes*, are called river dolphins on account of their habitat in the Amazons and the Yangtse River systems, respectively, it by no means follows that the fossil members of the family were confined to fresh water. Nevertheless, the name is convenient as a group designation.

The Florida specimen apparently represents an undescribed genus and species, which may appropriately be dedicated to Mr. Hudson in recognition of his generosity and of his lively interest in the fossils of the phosphate formation. Sellards (1915) in his account of the pebble phosphates of Florida indicates that these "deposits were accumulated

during either late Miocene or early Pliocene time." Some of the fossil vertebrates appear to be of fluviatile or estuarine origin, such for example as the iniid here discussed and the gavial *Tomistoma*.

Goniodelphis new genus

An iniid larger than the living *Inia;* beak very narrow, the tooth rows separated in the distal portion by a knife-like ridge, whence they suddenly diverge proximally to form an inverted Y. In the hinder part of the palate the two depressions between the (broken) vertical wing of the palatal and the midline, partially roofed over by the pterygoids when intact, form a pair of shallow gutters which are parallel instead of converging forward as in most small odontocetes; the floor of each gutter is smoothly continuous with the inner wall of the posterior nares as if it were in life open to the nasal passage. The latter slopes strongly upward and backward instead of being nearly vertical, forming an angle of some 30° with the plane of the palate. Posterior teeth with roots circular in section below the crown, but the tooth at the angle of the Y on each side triangular in section with the base of the triangle formed by the outer side. Derivation: *gonia,* angle, and *delphis,* dolphin, in reference to the wide angle of the tooth row.

Type. Goniodelphis hudsoni new species.

Goniodelphis hudsoni new species

Type. A portion of a cranium, No. 3920, Palaeont. Cat. Museum of Comparative Zoölogy, from phosphate deposit at Pierce, Florida. Collected by Mr. H. L. Hudson.

Horizon. Probably early Pliocene.

Description. The specimen consists of the basal part of the beak with palate, back to and including the nares; the proximal part of the tooth rows contains the roots of three teeth on the left side and eight on the right, distal to which are the broken alveoli for eight or nine additional pairs of teeth, narrowly spaced. The fragment indicates an animal about a third longer than the living *Inia.* The end of the narrow beak is missing but the part that is preserved represents possibly half the original length. The lateral portions of the maxillaries and orbit are broken away as is also the ventral region behind the posterior nares and the entire occipital wall; at the posterior dorsal rim, however, is the clear outline of the supraoccipital.

Dorsal aspect: There is a marked asymmetry in the maxillary and intermaxillary bones, those of the left side are narrower basally (from median line to right margin of skull at level of pre-orbital notch, 71 mm.; on left side, 47; width of right intermaxillary, 18; of left, 16 at same point). Dorsally the intermaxillaries taper forward to a combined width of 12 mm. at the broken tip against 34 at base; the two bones of opposite sides converge and unite at the level of the orbital notch, forming an elevated dorsal ridge with nearly vertical, slightly rounded sides, while proximally they diverge back to the level of the blowholes which they embrace. Anterior to the latter is a narrow, elevated and flattened area, about 130 mm. long. Below the intermaxillary ridge, the outer sides of the maxillaries are deep and nearly vertical, and set off from the ridge by a shallow lengthwise groove. Most of the posterior part of the maxillaries is lost, but on the left side enough remains to show that, as in *Inia*, they turn up posteriorly to form a wide shelf with a similar gutter-like depression between its outer edge and the blowholes. The latter are of about equal size (some 23 mm. each in transverse diameter). The nasal passage slopes strongly backward at an angle of about 30° with the plane of the palate. A shallow depression about 25 mm. long and deeper forward, is present at the hinder margin of each passage, marking the position of the squarish nasal bones. The summit of the skull was apparently less elevated than in *Inia;* its abraded outline is convex forward, brace-shaped posteriorly and about 32 mm. across its slightly truncated base. Immediately behind this summit (formed doubtless by the compressed frontals and parietals) is an emargination for the reception of the summit of the supraoccipital, convex forward on each side and concave medially,—brace-shaped,—with an extreme width of 55 mm.

Lateral aspect: The depth of the rostral part of the maxillary and its solidity are striking features. At the level where the tooth rows diverge the depth of the maxilla is 39 mm., that of the overlying ridge formed by the intermaxillaries 19, a total vertical depth of 58 mm. At this point too, a low lateral ridge commences at the upper third of the maxillary, running back along the rising lateral edge of the bone, and parallel to the ascending wing.

Ventral aspect: This view offers very distinctive characters. On the dextral side the orbito-maxillary projecting shelf is broken off apparently at its very base, leaving an indication of the bottom of the notch. From that point to the rim of the last alveolus of the tooth row is a space of 30 mm.; thence to the point where the alveolar rows of

opposite sides meet is a distance of 110 mm. On the sinistral side the distance is slightly less, 100 mm., since there is one less tooth on that side. On the dextral side of the specimen there are roots of eight teeth in place forward from the penultimate socket, to the point where the two rows meet; on the sinistral side but three at the latter point. In advance of this the alveolar rows become parallel and so closely approximated that only a narrow knife-like ridge intervenes between them. The alveolar walls are slightly broken away exteriorly so that it is difficult to make out the individual sockets of which there were apparently eight or nine similar in size to those of the proximal part of the row. Three striking characters here are:—(1) the extreme narrowness of the palate between the tooth rows that form the stem of the Y, and its sudden widening proximally so that the two alveolar rows forming the arms of the Y enclose between them an angle of about 50 degrees; (2) in the center of this enclosed triangular space is a narrow raised line of bone some 75 mm. long, on either side of which is a shallow lengthwise groove, 5 to 7 mm. wide, apparently corresponding to a similar ridge in *Inia*, formed by the vomer; (3) the tooth on each side at the point of divergence of the alveolar rows has the root still in place, and both are peculiar in being clearly triangular in section, with the longest side of the triangle external, and parallel with the maxillary border; the two other sides are shorter and subequal, forming the tip at the inner side. The next succeeding root on the dextral side is somewhat similar but less sharply angled, with the peak of the triangle external, while the corresponding tooth on the opposite side has a circular root and is less closely wedged against its neighbor. The remaining roots are circular or nearly so in section, one or two with slight evidence of a transversely oval form at the upper part of the root.

The region of the palatal bones is again characteristic. In *Inia* as in the delphinids, a thin blade-like wing extends ventrally from the lateral part of the palatal bone, cutting off a deep groove on each side of the median line in front of the posterior nares. In the delphinids the inner side of the pterygoids forms the anterior wall of the narial opening while the outer side folds over laterally to form a thin wall which unites with the palatal wing, thus completely enclosing a narrow fissure. In *Inia* this outer fold of the pterygoid is so short that it does not unite with the palatal wing, so that in the cleaned skull there is an open space between the two bones. In *Inia*, again, the two grooves enclosed by the palatal wings converge forward toward the mid-line of the skull. In the fossil skull here described the two grooves instead

are parallel to each other and relatively long (95 mm.), while their smooth surface is uninterruptedly continuous with the front wall of the nasal passage as if the latter had opened into the palatal fissure in life.

Posterior to the nasal passage the roof of the brain case is seen from within. What appear to be the two parietals may be outlined at the posterior border, some 22 mm. long, with a combined transverse width of 60 mm. where they abutted against the supraoccipital.

No part of the jaw was found, but evidently its rami were very closely approximated to form a long symphysis, then diverged abruptly and widely near the base of the rostrum, in correspondence with the sudden divergence of the upper tooth rows at that point.

Comparison with other iniids. In the table of fossil cetaceans accompanying his paper on 'The History of Whales', Dr. Remington Kellogg (1928) lists but five genera of Iniidae then known. Four of these are from Miocene formations of Argentina and one from the Miocene of California. Of these, *Anisodelphis* (*A. brevirostris* Rovereto) is based on a nearly complete jaw with long narrow symphysis, but in which only two or three teeth occur posterior to the divarication of the mandibles. Furthermore, with the sixth or seventh of the series (counting from the posteriormost tooth), the teeth become widely spaced and those of the two sides alternate instead of being opposite. Apparently Rovereto's (1915) *Saurodelphis acutirostris* is rather similar.

Ischyrorhynchus, as illustrated by True (1910, pls. 1–3) on the basis of a well-preserved skull which he describes under the name of *Diochotichus vanbenedeni*, shows a relatively broader rostrum, evenly tapering and with tooth rows widely separated, whereas in *Goniodelphis* the tooth rows are very closely approximated in front of the wide angle they make at the base of the beak.

The genus *Pontoplanodes* of Ameghino was based on a fragment of a very narrow rostrum, with tooth rows closely approximated as in *Goniodelphis*, but with rather remarkable alveoli, long and narrow, for six opposite pairs of teeth quite different from those of the latter with their circular roots in section. The rest of the composite specimen on which Burmeister based the name *Saurodelphis argentinus* is now believed to be identical with *Ischyrorhynchus vanbenedeni*. Its palatal aspect as figured by Abel (1909) shows very well the convergent palatal troughs and gradually tapering palate between the tooth rows.

The fourth Argentinian genus, *Proinia*, with the single species *P. patagonica* True (1909), was based on fragments of a cranium from the Patagonian beds, Santa Cruz Territory. No comparison is possible,

however, since the portions of the skull on which the genus and species were founded are practically the very ones missing in the Florida cranium.

Finally *Hesperocetus*, known from only the type species, *H. californicus* True (1912), is a larger animal with teeth widely spaced even in the symphyseal region, and in such a way that those of the upper series were received into depressions between those of the lower. It was discovered in the Upper San Pablo beds near Rodeo, California.

Of the two living genera, *Inia* and *Lipotes*, the former is perhaps the nearer related to the Florida animal as shown by its more approximated tooth rows and the much narrower summit of the supraoccipital. Both, however, are widely different in details.

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EXPLANATION OF PLATES

PLATE 1

PLATE 1

Goniodelphis hudsoni. Dorsal view of the type specimen. The dotted outline indicates the probable boundary of the maxillary shelf. x $\frac{1}{3}$. Eugene N. Fischer, del.

PLATE **2**

PLATE 2

Goniodelphis hudsoni. Ventral view of the type, showing (from front to back) the strongly approximated tooth rows, anteriorly, and their sudden wide divergence; the triangular section of the tooth roots at the angle of divergence; the median ridge anteriorly on the palate; the parallel grooves on the palatal bones; the brain case with outlines of the parietal bones at the posterior border. x $\frac{1}{3}$. E. N. Fischer, del.

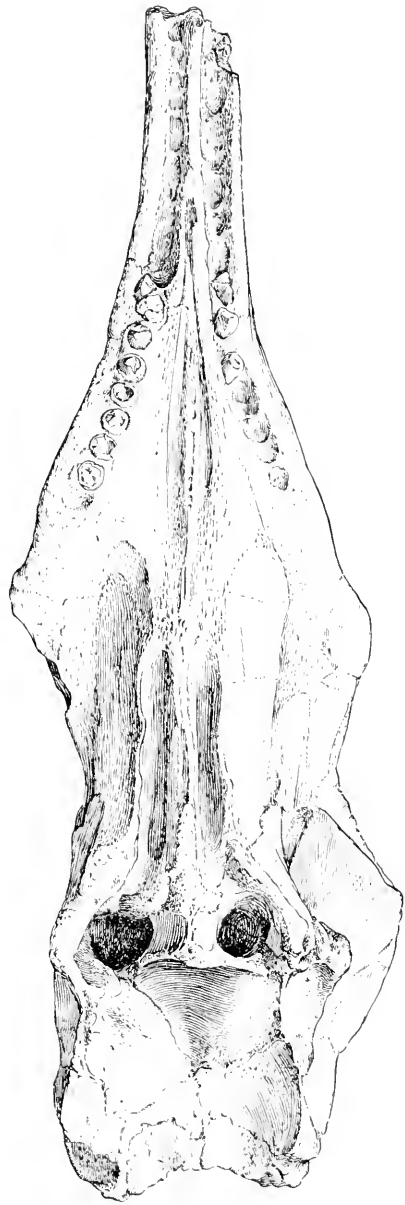

PLATE 3

PLATE 3

Goniodelphis hudsoni. Lateral view of the type specimen, showing the upturning maxillary wing, broken away. x $\frac{1}{3}$. E. N. Fischer, del.

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STUDIES IN CUBAN BLATTIDAE (ORTHOPTERA)

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WITH FOUR PLATES

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No. 2—*Studies in Cuban Blattidae (Orthoptera)*

By Ashley Buell Gurney

We sometimes think of the explorations of the early naturalists in the Neotropical Region, of men such as Humboldt, Bates, and Gundlach, and of the rare pleasure that must have been theirs on discovering unusual plants and animals where white men had never been before. Undoubtedly, many strange creatures in tropical America still remain unknown to science, often in highly inaccessible places, but only a few of us have the good fortune or initiative to seek them and thereby sense a joy of achievement akin to what the pioneer naturalists have known. One of the few North American entomologists to undertake seriously Neotropical exploration during recent years is P. J. Darlington of the Museum of Comparative Zoölogy, Harvard College, who has, by his collecting trips in the West Indies, greatly extended the frontier of our knowledge concerning the fauna of those islands, and who has found, especially in the higher mountains of the Greater Antilles, many strange, endemic insects. Dr. Darlington has brought back many remarkable Orthoptera, such as the katydids *Polyancistrus* and *Polyancistroides* (see Rehn, 1936, 1937b).

The Blattidae taken by Dr. Darlington in Cuba in 1936 were loaned to the writer for study by Nathan Banks. As the study progressed, and the importance of the collection became more apparent, the writer has been increasingly appreciative of the privilege of preparing this report.

For courtesies extended to the writer while visiting the Academy of Natural Sciences of Philadelphia for the purpose of comparing types and identified material with specimens from the present collection, thanks are due to J. A. G. Rehn, Curator of Entomology at that institution. As in connection with previous orthopterological studies, the privilege to consult the Academy Collection and the Hebard Collection located at the same institution is one for which the writer is particularly grateful.

The collection consists of 142 specimens, comprising 16 genera and 31 species. Of these, 8 species and 1 subspecies are here described as new. The holotypes and allotypes have been returned to the Museum of Comparative Zoölogy. One other new species, from the U. S. National Museum, is described.

The majority of specimens were taken in Oriente Province in the mountains that characterize the eastern part of Cuba, and many were collected on the slopes or at the summit of Pico Turquino, the highest

mountain in Cuba. This peak was not climbed until 1860 (see Taylor, 1916), and, like other peaks which with it constituted an island archipelago during certain stages of Pleistocene time, has many species peculiar to it. Schuchert (1935) discussed the geological history of Cuba, and Darlington (1938), the theoretical aspects of different ways in which the animals of the Greater Antilles may have been established, with reference to the principal animal groups for which population statistics of genera and species are available. Bates (1935) and Barbour (1923) have briefly treated the topography and geology of Cuba, and Rehn and Hebard (1927) published a guide to the West Indian Blattidae which is important in all future work on the roach fauna of those islands.

As a result of Dr. Darlington's collecting, series are now available of several species described by Rehn and Hebard in 1927 from one or very few specimens. The male of *Aglaopteryx mira* Rehn is here described for the first time. Especially in the case of *Cariblattoides instigator* R. & H. (see figs. 22, 23), the acquisition of a series shows that a great deal of variation occurs. Two of Bolivar's species described in 1888, *Pseudosymploce excisa* and *Epilampra eubensis*, have been "rediscovered." Modification of the generic limits of *Nelipophygus* has seemed advisable after studying a new species, *banksi*, which differs from the original generic diagnosis, but not sufficiently to warrant the proposal of a new generic name for it. Because the 1927 monograph by Rehn and Hebard is well supplied with keys and illustrations, it has not seemed necessary to prepare keys to species for all genera treated, but several keys have been given to supplement earlier ones, as in *Eurycotis*, to which several species have been added since 1927.

Some important observations have recently been made by Quadri (1940) on the male genitalia of *Blatta orientalis* L. and *Periplaneta americana* (L.). He describes four parts of the inner genitalia, left and right dorsal penis valves and left and right ventral valves. In the third instar the left ventral valve is incompletely separated from the left dorsal valve,[1] but is earlier differentiated and is distinguished in the adult on the basis of this interpretation. Following Snodgrass (1937), the writer uses "phallomere" rather than "penis valve." The *Blattella* type of genitalia (see Snodgrass, l. c., p. 47) is not discussed by Quadri. In valuable museum specimens of roaches it is not always advisable to make the dissections necessary for determination

[1] It is stated in Quadri's paper (p. 145) that in this stage the left ventral penis valve is incompletely separated from the right dorsal penis valve, but reference to the illustration indicated by Quadri (pl. 4, fig. 30) suggests that "left dorsal valve" is intended instead of "right dorsal valve."

of the exact homologies of visible phallomeres. In addition to the phallomeres, and the supraanal and subgenital plates which have long been used taxonomically, the paraprocts often constitute important characters (see Gurney, 1939, for a treatment of the paraprocts of *Nestoblatta*).

For the assistance of students, the following list of West Indian Blattidae described since 1927 is given. The islands of Tobago, Trinidad, Bonaire, Curaçao, and Aruba are usually not considered West Indian in their affinities, and the species recorded from them are included simply for the sake of completeness.

Aglaopteryx occulta Rehn 1932. Bermuda.
Aglaopteryx mira Rehn 1932. Cuba.
Aglaopteryx deria Rehn 1932. Puerto Rico.
Aglaopteryx absimilis Gurney 1937. Puerto Rico.
Aglaopteryx vegeta Rehn 1932. Jamaica.
Cahita misella Rehn 1937. Tobago.
Cariblatta advena Rehn 1932. Hispaniola.
Cariblatta faticana Rehn 1930. Cuba.
Cariblatta spinicauda Hebard 1929. St. Vincent; Grenada.
Cariblatta tobagensis Hebard 1929. Tobago.
Eurycotis histrio Rehn 1937. Hispaniola.
Eurycotis improcera Rehn 1930. St. Croix.
Eurycotis lixa Rehn 1930. Jamaica.
Hormetica pustulata Hebard 1929. Bonaire (north of Venezuela).
Nesomylacris fratercula Rehn 1930. Cuba.
Pseudosymploce personata Rehn 1930. Puerto Rico.
Styphon bakeri Rehn, new genus and new species. Bonaire; Aruba; Curaçao.

It should be noted, in addition, that *Sibylloblatta* was proposed by Rehn, 1937, for *Polyzosteria panesthoides* Walker of Jamaica.

Except for a few specimens so noted, all the material recorded in this paper is from Cuba. Some information, which is helpful in locating localities mentioned on pin labels, is given by Darlington (1937) in a paper on carabid beetles taken on the same trip.

Subfamily PSEUDOMOPINAE

The Genus AGLAOPTERYX Hebard

Aglaopteryx Hebard, Mem. Amer. Ent. Soc., No. 2, p. 30, 1917, (genotype, *A. gemma* Hebard, by original designation).

A synopsis of this genus by Gurney (1937) has recently appeared.

Key to the Cuban Species of Aglaopteryx

Small, length of pronotum about 3 mm.; interocular width less than three-fourths the distance between antennal sockets; male subgenital plate with left style slender and acuminate (see Rehn, 1932, pl. 7, fig. 2)..... *diaphana* (Fabricius)

Large, length of pronotum about 4.5 mm.; interocular width three-fourths or more the distance between antennal sockets; male subgenital plate without well developed left style, as in fig. 24
mira Rehn

AGLAOPTERYX DIAPHANA (Fabricius)

Blatta diaphana Fabricius, Ent. Syst., vol. 2, p. 11, 1792.

Material here recorded. 1 female, coast below Pico Turquino, Oriente Province, June 26–30, 1936 (P. J. Darlington) (M. C. Z.).

This specimen agrees with the descriptive notes by Rehn (1932), who pointed out that the identity of this species had been largely misunderstood by previous workers. Measurements are as follows: Length of body 8.8 mm., of pronotum 3 mm., of tegmen 6.35 mm., of hind tibia 4.5 mm.; width of pronotum 4.6 mm.

AGLAOPTERYX MIRA Rehn

Fig. 24

Aglaopteryx mira Rehn, Trans. Amer. Ent. Soc., vol. 58, pp. 110-112, pl. 7, figs. 8-10, 1932.

Material here recorded. 1 male, 5 females, 1 nymphal male, Pico Turquino (south side), Oriente Province, 3,000–5,000 feet, June 1936 (P. J. Darlington) (M. C. Z. & U. S. N. M.).

The species has hitherto been known only from three females. The present series of females agrees essentially with the original description. Differences in the distention of the abdominal segments account mainly for variation in body length, 11 to 15 mm., and in part for the fact that the tegmina of two specimens do not quite reach the apex of the abdomen. The two spots on the face between the antennal sockets figured by Rehn (1932, fig. 9) are not noticeable. The pronotal length varies from 4.3 to 4.8 mm.

Male. Essentially the same as female; tegmina and wings surpassing apex of abdomen by about one-half of length of cercus; interocular width three-fourths the distance between antennal sockets. Supraanal plate transverse, apex barely emarginate. Subgenital plate (fig. 24)

with left posterior angle broadly rounded, margin noticeably decurved; a flap along right lateral margin abruptly bent in apical third, thus extending posteriorly and in a vertical plane; a blunt, swollen, bifid, median projection on posterior margin, the surface of left lobe heavily rugose; a triangular, acute projection to the left of the bifid process.

Coloration. About as in female; disk of pronotum with side arms of an inverted anchor-shaped mark poorly developed, these arms connected by short marks to middle region of inner margin of each pronotal bar. Subgenital plate pale brown, darker on lateral borders and on bifid apical process; supraanal plate pale.

Measurements. Length of body 12 mm., of pronotum 4.5 mm., of tegmen 10.5 mm., of hind tibia 5.5 mm.; width of pronotum 6 mm.

The male nymph is 11.5 mm. long. In addition to the well-marked longitudinal pronotal bars, the disk of the pronotum has a conspicuous brown dot on each side, and along the middle line between them there is a weak longitudinal stripe which divides posteriorly. About eight brown dots occur on the posterior margin of the pronotum. The abdominal terga are spotted with brown, terga 4 and 5 more heavily so than the others.

The Genus CARIBLATTA Hebard

Cariblatta Hebard, Trans. Amer. Ent. Soc., vol. 42, p. 147, 1916, [genotype, *Blatta punctulata* Beauvois (replaced by *delicatula* Guérin because of preoccupation), by original designation].

This very characteristic West Indian genus of small, active roaches, represented by 23 species on the islands, is poorly represented in Cuba as regards number of species. *Cariblatta faticana* Rehn is known from a single female from Turquino Peak.

Key to the Cuban Species and Subspecies of Cariblatta

1. Pronotal pattern consisting of numerous dots of different sizes and more or less parenthesis-shaped marks; tegminal veins without conspicuous nodes. 2

   Pronotal pattern essentially limited to two conspicuous dots on disk; most of costal veins and discoidal sectors of tegmen bearing on their dorsal surfaces one or more low rounded nodes. *faticana* Rehn

2. Tinged with olivaceous; tegmina surpassing apex of abdomen, the latero-posterior angles of the pronotum being broadly rounded and the point of greatest pronotal width being about one-third

of the pronotal length anterior to the posterior margin; wings fully developed..... *delicatula* (Guérin)

Tinged with cinnamon; tegmina not reaching apex of abdomen except rarely, in short-tegmined specimens the latero-posterior angles of the pronotum being abruptly rounded and the point of greatest pronotal width being near posterior margin; wings vestigial..... *lutea minima* Hebard

Cariblatta delicatula (Guérin)

Blatta (Phyllodromia) delicatula Guérin, in La Sagra, Hist. Phys. Polit. Nat Cuba, pp. 346–347, 1857.

Material here recorded. 1 male, 1 female, Maisi, Oriente Province, July 17, 1936; 2 males, mountains north of Imias, Oriente Province, 3,000–4,000 feet, July 25–28, 1936; 2 males, Loma del Gato, Cobre Range, Oriente Province, about 3,000 feet, July 3–7, 1936; 1 male, 1 female, Pico Turquino (south side), Oriente Province, 2,000–5,000 feet, June 1936; 1 female, same, 1,500 feet, June 25, 1936; 4 males, 4 females, coast below Pico Turquino, Oriente Province, June 26–30, 1936; 1 male, Buenos Aires, Trinidad Mts., Santa Clara Province, 2,500–3,500 feet, May 8–14, 1936; 2 females, Soledad (near Cienfuegos), Santa Clara Province, April 1936 (P. J. Darlington) M. C. Z. & U. S. N. M.).

The above material demonstrates the great variation found in this species which has already been discussed by Hebard (1916a, pp. 158–163) and Rehn and Hebard (1927, pp. 25–29). No species could better show the need for larger series in order to understand the amount of variation within a species or illustrate more clearly the fact that male genitalia, as well as other structural features, may vary widely. The posterior margin of the male subgenital plate varies from slightly concave to produced into a short median tongue. In one male (Buenos Aires) the projection is square, with a truncate apex; the projection in other specimens possessing a median tongue is bluntly rounded or triangular. The style at each latero-posterior angle varies from a tiny lobe armed at the base with a strong, curved spur and a small accompanying spur to an elongate lobe armed with several spurs of various lengths along its outer and apical margins. Body size likewise varies greatly, the tegminal length ranging from 6.5 to 11 mm. in the male. There is an opportunity here for a fine contribution by some West Indian student interested in biology of insects who could rear this

species in quantity in order to tabulate the variation occurring in the progeny of known original stock.

Cariblatta lutea minima Hebard

Cariblatta lutea minima Hebard, Trans. Amer. Ent. Soc., vol. 42, pp. 170–172, pl. 13, fig. 4, 1916.

Material here recorded. 2 females, Soledad (near Cienfuegos), Santa Clara Province, April 1936; 1 female, same, May 1936 (P. J. Darlington) (M. C. Z. & U. S. N. M.).

Readers are referred to Hebard (1917, pp. 50–56) and Rehn and Hebard (1927, p. 29) who have discussed this roach. The present subspecies occurs in Cuba and in the central and southern portions of Florida. *C. lutea lutea* (S. & Z.) is known from northern Florida to Cape Henry, Va., and westward to Natchez, Miss. The male subgenital plate of *minima* bears at each latero-posterior angle a short lobelike style armed with curved spurs. The posterior margin has a subquadrate median projection. It is unusual for a median projection of this shape to occur in *delicatula*, but the genitalia may not be depended upon to separate the two species.

In addition to the distinguishing features noted in the key, the interocular distance of *minima* averages somewhat greater than that of *delicatula*. The differences in pronotal shape represent the progressive changes that occur in many species as an accompaniment of brachypterism. The only recorded specimen with long tegmina is the one from Baños de San Vincente, Pinar del Rio Province, Cuba, mentioned by Rehn and Hebard (l. c., p. 29). No specimens with long wings are known.

The Genus Cariblattoides Rehn and Hebard

Cariblattoides Rehn and Hebard, Bull. Amer. Mus. Nat. Hist., vol. 54, art. 1, p. 48, 1927 (genotype, *C. suave* Rehn and Hebard, by original designation).

Only the originally described species, *suave* and *instigator*, are known, but additional material suggests certain modifications in the key prepared in 1927. *C. instigator* was based on one male and five nymphs, and the present series of nine individuals, including two females, shows that much variation occurs. Three previously unrecorded males of *suave*, one from Rio Piedras, P. R., and two from Puerto Rico intercepted in quarantine at San Francisco, give further information about that species.

Key to the Species of Cariblattoides

Pronotum with two posteriorly diverging longitudinal dark bars on disk; tegmen with pale borders on both costal and anal margins; head with a distinct, transverse, dark interocular bar; male subgenital plate (figs. 22, 23) with both sides about equally developed. (Cuba) ..... *instigator* Rehn and Hebard

Pronotum with disk entirely dark, the dark area narrowing anteriorly; tegmen with pale costal border, anal margin entirely dark; interocular area often darkened, but not in a sharply defined bar; male subgenital plate (Rehn and Hebard, l. c., pl. 3, fig. 4) with left side much more developed and produced posteriorly than right side. (Puerto Rico) ..... *suave* Rehn and Hebard

CARIBLATTOIDES INSTIGATOR Rehn and Hebard

Figs. 22, 23

Cariblattoides instigator Rehn and Hebard, Bull. Amer. Mus. Nat. Hist., vol. 54: art. 1, pp. 52–54, pl. 3, figs. 6–9, 1927.

Material here recorded. 1 male, mountains north of Imias, 3,000–4,000 feet, July 25–28, 1936; 1 male, 2 females, Gran Piedra Range (near Daiquiri, between Santiago and Guantanamo), 2,000–3,000 feet, May 30–31, 1936; 1 male, summit of Pico Turquino, 6,000 feet, June 16–21, 1936; 1 male, Pico Turquino (south side), 3,000–5,000 feet, June 1936; 2 males, same, 1,500 feet, June 25, 1936; 1 male, coast below Pico Turquino, June 26–30, 1936. All Oriente Province (P. J. Darlington) (M. C. Z. & U. S. N. M.).

In the present series the fifth (apical) segment of the maxillary palpus averages distinctly shorter than the fourth, but not so much so as in *suave*. The number of small spines on the ventro-anterior margin of the front femur ranges from 8 to 13 with an average of 10.8; the range is 9 to 10 in the 2 females. In the 3 herein recorded males of *suave*, the spine range is 7 to 9. The number of tegminal discoidal sectors is 5 to 7 and 5 to 6, respectively, in the males and females of *instigator*, 6 to 7 in *suave*.

The most conspicuous variation of *instigator* occurs in the male subgenital plate. One specimen (mountains north of Imias) (fig. 23) has a slender projection of the posterior margin of the subgenital plate, the styles being specialized as groups of strong curved spurs arising from a non-sclerotized area at the apex of each latero-posterior extension of the subgenital plate. Four specimens are as in fig. 22.

In this type there is no median projection, but there is a deep emargination, while the styles arise from an unsclerotized area that is formed on the same plan as in fig. 23 except for less specialization. There is a thin, partly transparent area at the base of the median apical emargination. A specimen from the south side of Pico Turquino is about as illustrated by Rehn and Hebard (l. c., pl. 3, fig. 9) as regards the median projection and the general shape of the subgenital plate, but the styles are represented by clusters of spurs about as in fig. 22. The single male from the summit of Pico Turquino is much like fig. 23 except that the styles converge so that they virtually meet near the tip of the median projection, curving so that an opening is left along each side of the median projection. This male likewise differs from the other specimens, perhaps in response to the high altitude, by being of darker general coloration (the venter of the abdomen is mostly brown except for pale margins and a few spots), by the tegmina not quite reaching the apex of the abdomen, by the wings being vestigial, and by the pronotum being more semicircular than transversely elliptical as a result of brachypterism. If this specimen actually represents a population restricted to high elevations, it probably is a distinct subspecies of *instigator*. Further collecting may supply information on this subject. In two males of the above series the supraanal plate is narrowly incised apically; the apex of the others is entire. In each of two males there is a right phallomere extruded, which is in the form of a slender, curved, and somewhat twisted hook, recurved apically and armed with two sharp teeth. Tegminal length of the normal males varies from 9.5 to 11 mm. Measurements of the short-winged male from the summit of Turquino follow: Length of body 7 mm., of pronotum 2.4 mm., of tegmen 5 mm., of hind tibia 3 mm.; width of pronotum 3.5 mm. Females agree essentially with males in color and structure. The interocular space is not noticeably wider in the female. The female supraanal plate is transverse, weakly bilobed at the apex, and the apical margin has sparsely distributed, long, slender, spinelike setae. The subgenital plate is simple, scooplike, extending about half its length beyond the supraanal plate; it is pale buff, darker along the lateral margins. Measurements of a female are as follows: Length of body 8.2 mm., of pronotum 2.5 mm., of tegmen 10.8 mm., of hind tibia 3.9 mm.; width of pronotum 3.4 mm.

The Genus NEOBLATTELLA Shelford

Neoblattella Shelford, Ent. Mo. Mag., vol. 47, p. 155, 1911 (genotype, *Blatta adspersicollis* Stål, by original designation).

Few American genera of Blattidae are comparable to *Neoblattella* in the rich number of species, but only two species are known from Cuba, one of them here described as new.

Key to the Cuban Species of Neoblattella

Posterior margin of male subgenital plate (fig. 32) prominently incised and with a small spine each side of emargination
guanayara, new species

Posterior margin of male subgenital plate (fig. 38) not incised and without spines ..... *vatia* Rehn and Hebard

NEOBLATTELLA VATIA Rehn and Hebard

Fig. 38

Neoblattella vatia Rehn and Hebard, Bull. Amer. Mus. Nat. Hist., vol. 54, art. 1, pp. 63–66, pl. 5, figs. 1–6, 1927.

Material here recorded. 1 male, Upper Ovando River (the mouth of which is just south of Cape Maisi), Oriente Province, 1,000–2,000 feet, July 17–20, 1936; 1 female, Loma del Gato, Cobre Range, Oriente Province, about 3,000 feet, July 3–7, 1936; 1 male, Pico Turquino, Oriente Province, 5,000–6,000 feet, June 1936; 1 male, same, 6,000 feet (summit), June 16–21, 1936; 4 males, 2 females, same, 3,000–5,000 feet (south side), June 1936; 1 male, same, 1,500 feet, June 25, 1936.

The origin of the holotype is unknown, beyond that it is from Cuba, but the other original material is from Pinar del Rio and Havana Provinces. The apex of the male subgenital plate is not produced in a swollen protuberance nearly so much in the types as in the present series (fig. 38), but all evidently represent the same species. Within the present series some variation occurs. Further collections may show that the population in eastern Cuba is a distinct subspecies. The apical margin of the male subgenital plate separates *vatia* from *guanayara* (figs. 32, 38). The tegmina of two males (5,000–6,000 feet, and summit of Turquino) are noticeably shorter than those of the other specimens here recorded. The tegmen of the male from the summit of Turquino is 10 mm. long; that of the male taken at 1,500 feet is 17 mm. long.

NEOBLATTELLA GUANAYARA, new species

Fig. 32

Male (holotype). Differing from *vatia* especially in subgenital plate. Head with interocular space narrower than distance between antennal

sockets (as 2.7 to 3.6); pronotum slightly more transverse, rather more delicate than in *vatia*; ulnar vein of wing with four complete rami, each of the two most apical ones twice furcate; axillary vein with two branches, the basal one furcate near its base and each fork furcate about midway of its length; apical margin of supraanal plate narrowly concave, the margin of concavity appearing as two obtuse angles (this condition occurs in some males of *vatia*, in others the margin is entire). Subgenital plate with a large hooked style at each postero-lateral angle, as in fig. 32 in ventro-posterior view; a small curved spine near base of each style; apical margin weakly obtuse-angulate (in ventral view), prominently incised; a small curved spine each side of emargination; a median, slightly oblique, longitudinal ridge in posterior half of plate, culminating in a protuberance extending ventrad of emargination; lateral portions of plate abruptly curved dorsad and situated nearly vertically, serving as bases for respective styles.

Coloration. In general, light straw-colored, much as in *vatia*. Eyes black; interocellar area light brown with a pale central spot enclosed with dark; antenna brown, pale at base; pronotum, tegmina, wings, legs, and abdomen as in *vatia*; supraanal and subgenital plates light brown; cercus whitish yellow above, margined laterally with brown, ventral surface of segments pale, blotched basally and margined laterally with brown.

Measurements. Length of body 11.5 mm., of pronotum 3.5 mm., of tegmen 15 mm., of hind tibia 6.5 mm.; width of pronotum 4.7 mm.

Female (allotype). Interocular area slightly wider than in male, in respect to distance between antennal sockets as 3 to 3.8; supraanal plate with a V-shaped emargination as in *vatia*; subgenital plate simple, scooplike, extending somewhat beyond supraanal plate.

Coloration. As in male; supraanal plate brown on base, apical half pale; subgenital plate dark brown, darkened on margins, pale on central part of disk, a pale basal blotch with dark-brown dot on each lateral border.

Measurements. Length of body 10.8 mm., of pronotum 3.6 mm., of tegmen 14.7 mm., of hind tibia 6.2 mm.; width of pronotum 4.7 mm.

Type locality. Buenos Aires (about 17 miles northwest of Trinidad), Trinidad Mts., Santa Clara Province, Cuba.

Type. Museum of Comparative Zoölogy.

The type and allotype were taken by P. J. Darlington at the type locality, 2,500–3,500 feet, May 8–14, 1936. Buenos Aires is near the headwaters of the Rio Guanayara and the Rio San Juan, from the former of which the specific name is taken.

The Genus PSEUDOSYMPLOCE Rehn and Hebard

Pseudosymploce Rehn and Hebard, Bull. Amer. Mus. Nat. Hist., vol. 54, art 1, p. 103, 1927, (genotype, *P. schistopyga* Rehn and Hebard, by original designation).

Since 1927, Rehn (1930) has described *personata* from Puerto Rico, and now *excisa* (Bol.) has been taken in Cuba, doubling the number of species reported from American collections when the revision of West Indian roaches was written. Both *personata* and *excisa* have four complete rami of the ulnar vein of the wing, and the tegminal discoidal sectors of *excisa* are weakly oblique, thus modifying slightly the original generic description, which states that the complete rami are three in number and the discoidal sectors are longitudinal. The descriptions and illustrations of the 1927 revision should be consulted in conjunction with the key below.

Key to the Species of Pseudosymploce

1. Noticeably bicolored, anterior and lateral margins of pronotum and costal margin of tegmen yellow in contrast to dark-brown basal color; apex of female supraanal plate entire. (Discoidal sectors of tegmen about 12 in number.) (Puerto Rico)
   personata Rehn

   General color uniform, either solid blackish brown or pale tinged with auburn or rufous; apex of female supraanal plate bilobate or emarginate. 2
2. Large, blackish brown, tegminal length about 20 mm. or more; head entirely black or blackish brown except clypeus, which is pale brown; discoidal sectors of tegmen about 12. (Cuba)
   excisa (Bolivar)

   Smaller, reddish brown to pale, tegminal length about 14–17.5 mm.; head not nearly so uniformly dark as in *excisa*; discoidal sectors of tegmen about 8. 3
3. Posterior margin of male supraanal plate with median emargination much broader than length of posterior processes. (Jamaica)
   schistopyga Rehn and Hebard

   Posterior margin of male supraanal plate with median emargination no broader than length of posterior processes. (Hispaniola)
   elongata (Beauvois)

PSEUDOSYMPLOCE EXCISA (Bolivar)

Ischnoptera excisa Bolivar, Mém. Soc. Zool. France, vol. 1, p. 124, 1888.

Material here recorded. 1 female, mountains north of Imias, Oriente Province, 3,000–4,000 feet, July 25–28, 1936 (P. J. Darlington) (M. C. Z.)

This specimen agrees very closely with Bolivar's description and, except as already noted, fits the original generic description perfectly. According to Gundlach (1890–91, p. 303), Bolivar's material came from Yateras, Oriente Province; this is scarcely 30 miles from Imias. The rediscovery of *excisa,* unknown since its description more than a half century ago, is of genuine interest.

Female. Large for genus, rather robust; surface smooth and glossy. Narrowest width of interocular space slightly wider (about as 5.5 to 5) than distance between antennal sockets; eye extending far ventrally, to a point fully one-half distance between level of ventral margin of antennal socket and lateral articulation of mandible. Maxillary palpus with segments 5 and 4 subequal in length, each slightly shorter than segment 3; segments slender, apical one very shallowly, triangularly hatchet shaped in lateral view. Pronotum as in *elongata.* Tegmen exceeding tips of cerci by distance about equal to pronotal length; number of costal veins about 20; discoidal vein forked about midlength of tegmen, the posterior branch forked one-fifth the distance from origin of vein to apex; discoidal sectors 12 (inclusive of ulnar vein and exclusive of posterior fork of discoidal vein), weakly oblique. Wing reaching about to apex of tegmen; costal veins 14, including mediastine vein, which extends across bases of about 6 costal veins, forming about 7 closed cells anterior to middle third of discoidal vein; median vein simple; ulnar vein with 4 complete and 3 incomplete rami; intercalated triangle about one-fifth as long as length of anal sulcus; axillary vein with 2 simple branches, in addition to main stem; radiate veins 13. All femora much compressed; ventro-anterior margin of front femur with 8 large spines, the apical 2 considerably shorter than the others, then 8 small, uniform, setalike spines; other legs about as in *elongata.* Supraanal plate transverse, moderately produced, the apex with deep, broadly V-shaped emargination; subgenital plate simple, bluntly rounded at apex, noticeably surpassing supraanal plate posteriorly.

Coloration. General color blackish brown; tegmen tinged with metallic luster; pronotum mostly dark reddish brown except for a darker, wide, posterior border; eyes blackish; occiput and face dark reddish brown; clypeus paler; antennal sockets and ocellar spots light yellow; antenna light brown, darker at base; maxillary palpus brown, apical segment pale in apical half; legs brown; wing hyaline, fuscous along anterior border and in apical third of anterior field; abdomen

dark brown, lighter in middle region of venter; cerci and supraanal plate dark.

Measurements. Length of body 17 mm., of pronotum 5.4 mm., of tegmen 21.5 mm., of hind tibia 8.5 mm.; width of pronotum 6.4 mm.; greatest width of tegmen 6.5 mm.

The Genus ISCHNOPTERA Burmeister

Ischnoptera Burmeister, Handb. Ent., Bd. 2, Abt. 2 (1st half), p. 500, 1838, (genotype, *Ischnoptera morio* Burmeister, designated by Kirby, 1906).

Many species of *Ischnoptera* inhabit Central and South America, but only three have been found in Cuba. Elsewhere in the West Indies, *podocrs* R. & H. and *orcochares* R. & H. occur in Jamaica, *rufa rufa* (Deg.) is widely distributed in the Greater and Lesser Antilles, and *ligula* R. & H. was recorded from Hispaniola by Rehn and Hebard (1927, p. 119) on the basis of two females.

Key to the Cuban Species and Subspecies of Ischnoptera

1. Large, chestnut colored, width of pronotum usually at least 5 mm., occasionally about 4 mm.; apex of male supraanal plate (Hebard, 1916b, pl. 16, fig. 3) entire ..... *rufa rufa* (Degeer)
   Smaller, usually less reddish, width of pronotum about 2.5 to 3.5 mm.; apex of male supraanal plate (fig. 25, 31) conspicuously emarginate 2
2. Male supraanal plate (fig. 31) very deeply incised, appearing asymmetrically bilobed ..... *darlingtoni*, new species
   Male supraanal plate very differently emarginate from above, about as in fig. 25 ..... *ligula* Rehn and Hebard 3
3. Robust; length of tegmen about 10–11 mm.; middle part of apex of male subgenital plate recurved dorsally, bearing a very specialized right style (fig. 26); apical emargination of male supraanal plate averaging larger (fig. 25) .... *ligula collina*, new subspecies
   Less robust; length of tegmen about 8.5 mm.; apex of male subgenital plate not recurved dorsally, right style less specialized (Rehn and Hebard, l. c., pl. 9, fig. 7); apical emargination of male supraanal plate averaging smaller than above
   ligula ligula Rehn and Hebard

ISCHNOPTERA RUFA RUFA (Degeer)

Blatta rufa Degeer, Mém. Hist. Ins., vol. 3, p. 539, pl. 44, fig. 7, 1773.

Material here recorded. 1 male, intercepted at Boston, Mass., in quarantine from Cuba, 1932; 1 male, intercepted at Norfolk, Va., in quarantine from Cuba, April 6, 1937 (U. S. N. M.).

By coincidence Brunner (1865, p. 131) used the same specific name in describing his synonymous *Ischnoptera rufa* from Brazil. Moreover, Brunner omitted reference to Degeer's *rufa* in his review (l. c., p. 30) of the work of that author. Kirby (1904) omitted Degeer's name also, but later included it (1910, p. 566) as a species of uncertain position. The synonymy of *rufa* Brunner was published by Shelford (1908, p. 8). This species should not be confused with *Blatta rufa* (Tepper) of Australia.[1]

This is the first Cuban record of *rufa rufa*, which elsewhere occurs throughout the West Indies and on the mainland from Nicaragua southward over much of northern South America. Hebard (1916b, 1920) has illustrated the male genitalia. The subspecies *rufa debilis* Hebard occurs "in the higher country of Costa Rica," and *rufa occidentalis* Saussure from Panama northward.

Ischnoptera darlingtoni, new species

Figs. 27–31

This species is most closely related to *ligula* and *orcocharcs*, from both of which it differs in the male genital structures.

Male (holotype). General form slender; prnontum and tegmina polished. Head rather narrow in frontal view; interocular area narrower than distance between antennal sockets (as 2.5 to 3.2); face moderately inflated; segment 5 of maxillary palpus elongate-lanceolate in lateral view, about one and one-third times as long as segment 4; pronotum as in *ligula*. Tegmen exceeding apex of abdomen by distance of 5 mm.; costal veins (including mediastine vein) 21 in number; discoidal sectors as in *ligula*, 9 to 11 in number. Wing with about 19 costal veins; ulnar vein with 2 complete and 5 incomplete rami; intercalated triangle small, about one-fifth the length of anal sulcus; axillary vein with 2 branches; about 10 radiate veins. Ventro-anterior margin of front femur with 1 strong spine and several very slender, long ones along basal portion; about 12 setalike spines in apical half; 3 large spines at extremity as in *ligula*. Other legs about as in *ligula*.

Supraanal plate (fig. 31) deeply incised; right lobe deeply concave ventrally, with numerous small spines closely set along margins ven-

[1] Described by Tepper (1893, p. 101) as *Periplaneta rufa*. Transfer of the species to *Blatta* by Kirby (1904, p. 139) and Shelford (1910, p. 16) made this a secondary homonym. Accordingly, *Blatta tepperana*, new name, is here proposed for the Australian species.

trally; left lobe somewhat concave ventrally, a group of long, strong spines directly obliquely on inner margin, another group of spines at left near base ventrally. Subgenital plate appearing as in fig. 30 in dorso-posterior view, a median dorsally recurved flap bearing highly specialized right style (fig. 27); left style slender, acute, bearing three lateral spines. Left and right paraprocts as illustrated (figs. 28, 29), respectively.

Coloration. General color light brown; interocular area and dorsal part of face orange yellow; ventral part of face and palpi pale; ocellar spots white, tinged with pinkish; antenna buff, basal three segments pale. Pronotum bordered laterally and anteriorly with pale yellow; disk orange yellow, bordered with fuscous in a wide posterior border and posterior to the anterior pale border. Tegmen light brown, washed with whitish along costal margin indistinctly toward apex; apex of tegmen and posterior half of discoidal field grading into hyaline. Wing membrane colorless; costal veins clouded in middle third of wing; veins light brown. Legs pale; tarsi and spurs somewhat darker. Abdomen pale, darker toward apex ventrally and on posterior portions of terga.

Measurements. Length of body 9 mm., of pronotum 2.7 mm., of tegmen 12.5 mm., of hind tibia 4 mm.; width of pronotum 3.5 mm.

Female (allotype). General form as in male; somewhat larger and more robust. Interocular space slightly wider than distance between antennal sockets (about as 4 is to 3.7). Tegmen with about 26 costal veins; 11 discoidal sectors. Wing with 2 complete and 7 to 8 incomplete rami of ulnar vein. Front femur with 2 large spines basad of setalike spines on ventro-anterior margin. Supraanal plate transverse; apex blunt, about a right angle. Subgenital plate equal in length to supraanal plate, apical margin broadly and evenly rounded.

Coloration. About as in male, but slightly more tinged with orange yellow. Ocellar spots white.

Measurements. Length of body 9.5 mm., of pronotum 2.7 mm., of tegmen 12.5 mm., of hind tibia 4 mm.; width of pronotum 3.4 mm.

In addition to the type and allotype just described, there is 1 male paratype. The armature of the right style varies slightly from that of the type. There are about 20 costal veins in the tegmen, and the complete and incomplete rami of the ulnar vein of the 2 wings are, respectively, 2 and 6, and 2 and 5. There are 2 large spines on the ventro-anterior margin of each front femur. The coloration tends more toward fuscous and less toward orange yellow than in the type.

Type locality. Mountains north of Imías, Oriente Province, Cuba.

Type. Museum of Comparative Zoölogy.

Paratype. U. S. National Museum, No. 54826.

The holotype was taken at an altitude of 3,000–4,000 feet, July 25–28, 1936, by P. J. Darlington, in whose honor the species is named. The allotype is from Pico Turquino (south side), Oriente Province, 3,000–5,000 feet, June 1936. The paratype is from Loma del Gato, Cobre Range, Oriente Province, about 3,000 feet, July 3–7, 1936. The allotype and paratype also were taken by Dr. Darlington.

Ischnoptera ligula collina, new subspecies

Figs. 25, 26

This roach differs from *ligula ligula* as noted in the key, by the larger number of areolets between the discoidal and median veins of the wing, by a slightly wider interocular space, and by a smaller average number of large spines along the basal half of the ventro-anterior margin of the front femur. Typical *ligula* occurs at low altitudes in both western and eastern Cuba, and the present form appears to be a subspecies occurring at higher elevations (the name *collina* means "one who dwells among the hills").

Male (holotype). Interocular width less than distance between antennal sockets (about as 2.5 to 3.4) (a male paratype of *ligula ligula* is as 2.2 to 3.5); ventro-anterior marign of front femur with 1 large spine basad of a row of fine setalike spines; wing with 12 subquadrate areolets between discoidal and median veins (8 to 10 in paratypes of *ligula ligula*). Supraanal plate (fig. 25) somewhat asymmetrical at base; lateral portions recurved ventrally; apical emargination, accentuated by curvature of lateral portions, deeply rounded; numerous small setae lining apical portion within; sparse elongate setae as illustrated. Subgenital plate, as in fig. 26 in dorso-posterior view, with apical margin recurved dorsally; left style slender, gently curved, acute, bearing a small lateral spine; right style sulcate dorsally in basal half, armed with 3 heavy spines. Left paraproct bearing a slender arm, with an acute apical spine; right phallomere slender, curving dorsally, then ventrally and to the left near base of right style, bearing a curved apical spine.

Coloration. Essentially as in *ligula ligula*.

Measurements. Length of body 8.5 mm., of pronotum 2.3 mm., of tegmen 11 mm., of hind tibia 3.8 mm.; width of pronotum 3.1 mm.

Female (allotype). Much like male; interocular space subequal to distance between antennal sockets; about 15 areolets between discoidal and median wing veins; ulnar vein with 2 complete and 4 incomplete

rami of ulnar vein. Supraanal plate with lateral margins broadly rounded, apex shallowly and narrowly emarginate; subgenital plate with apex broadly rounded and briefly reflexed dorsally.

Coloration. Essentially as in male.

Measurements. Length of body 7.5 mm., of pronotum 3 mm., of tegmen 10.5 mm., of hind tibia 3.5 mm.; width of pronotum 3.2 mm.

In addition to the type and allotype, there are 2 male and 2 female paratypes. One female has 2 large spines on the ventro-anterior margin of each front femur; the second female has 1 spine on 1 femur and 2 on the other. A spread wing of 1 male paratype has about 14 areolets between the discoidal and median veins of the wing, and 1 female has about 18 areolets; the tegmen of the latter specimen measures 11.5 mm., and the supraanal plate is entire apically.

Type locality. Loma del Gato, Cobre Range, Oriente Province, Cuba.

Type. Museum of Comparative Zoölogy.

Paratypes. U. S. National Museum, No. 54827, and Museum of Comparative Zoölogy.

The holotype was collected at an elevation of about 3,000 feet, July 3–7, 1936. The allotype, one male paratype, and one female paratype bear the same data as the type. One male paratype is from the Gran Piedra Range (near Daiquiri), Oriente Province, 2,000–3,000 feet, May 30–31, 1936. One female paratype is from Buenos Aires, Trinidad Mts., Santa Clara Province, 2,500–3,500 feet, May 8–14, 1936. All the material was collected by P. J. Darlington. The two paratypes from the type locality are deposited in the U. S. National Museum.

The Genus NELIPOPHYGUS Rehn and Hebard

Nelipophygus Rehn and Hebard, Bull. Amer. Mus. Nat. Hist., vol. 54, art. 1, p. 122, 1927 (genotype, *N. ramsdeni* R. & H., by original designation and by monotypy).

The material collected by Dr. Darlington in Oriente Province of this unusual Cuban genus adds to our knowledge of the variation occurring in *ramsdeni* and includes a new species the characters of which necessitate two modifications in the original generic diagnosis. The tegmen of *banksi* is truncate and weakly concave and oblique at the apex (fig. 35), rather than arcuate-truncate with the greatest length on the inner margin as in *ramsdeni*. The arolia are small but distinct (fig. 36) instead of absent as in *ramsdeni*.

The close similarity of the two species in other important characters and in habitus, together with their occurrence in the same part of

Oriente Province, indicates clearly that they belong to the same natural group. Accordingly, the limits of *Nelipophygus* are modified to include *banksi*. In the key to West Indian genera of Pseudomopinae (Rehn and Hebard, 1927, pp. 5–7) ,*banksi* ends blindly near *Ischnoptera* and *Nelipophygus*, but the substitution of "Arolia absent or much reduced in size" for "Arolia absent" eliminates the difficulty. Neither species runs directly through couplet 1 of that key, since their vestigial wings do not provide the characters there required, but by elimination the student will recognize them as members of the group Ischnopterae and then arrive at *Nelipophygus* by the key characters.

Nelipophygus ramsdeni Rehn and Hebard

Nelipophygus ramsdeni Rehn and Hebard, Bull. Amer. Mus. Nat. Hist., vol. 54, art. 1 pp. 123–126, pl. 9, figs. 8–13, pl. 10, figs. 1–3, 1927.

Material here recorded. 1 female, Upper Ovando River (the mouth of which is just south of Cape Maisi), Oriente Province, 1,000–2,000 feet, July 17–20, 1936 (P. J. Darlington) (M. C. Z.)

This specimen has been compared with the types at Philadelphia and found to differ from the female allotype in smaller size and a lighter shade of brown. These differences may represent individual variation or reflect the influence of environment. Measurements are as follows: Length of body 15 mm., of pronotum 5.25 mm., of tegmen 5.7 mm., of hind tibia 6.4 mm.; width of pronotum 6.6 mm., of tegmen 4.6 mm.

Nelipophygus banksi, new species

Figs. 34–37

This distinct species differs from *ramsdeni* in the small arolia, differently shaped tegmina, more expanded hind tibiae, less elongate projection on the posterior margin of metanotum, and in differences in the male subgenital plate.

Male (holotype). General body form as in *ramsdeni*; dorsal surface moderately shining. Interocular space much wider than distance between antennal sockets (as 10 to 6.6); antennae, eyes, and palpi as in *ramsdeni*. Pronotum with sides decurved hoodlike anteriorly, concealing head from above; a few punctations; shape as in *ramsdeni*. Tegmen (fig. 35) subquadrate, greatest length on costal margin; latero-posterior angle reaching midway on tergum 2; inner posterior angle falling short of posterior margin of metanotum; apical margin weakly oblique, slightly concave; venation as illustrated. Wing a vestigial pad, reaching to posterior margin of metanotum, concealed by tegmen

in dorsal view. Posterior margin of metanotum with blunt, obtuse-angled projection (not long and acutely spinelike as in *ramsdeni*.) Front and middle legs like those of *ramsdeni* except for presence of small arolia; ventral margins of hind femur with six to eight sturdy spurs; hind tibia noticeably more flattened and expanded than in *ramsdeni*, a broad, shallowly concave area on the surface of apical third adjoining external margin and extending two-thirds width of tibia, not grooved or so definitely limited in area as in certain species of *Eurycotis* (fig. 4); hind tarsus as in *ramsdeni* except for arolium (fig. 36). Abdomen shaped as in *ramsdeni;* posterior half of dorsal surface with conspicuous, recumbent, sparsely distributed setae; supraanal plate about as in *ramsdeni,* slightly emarginate apically; a left phallomere large, hooked, similar to that of *ramsdeni* (see Rehn and Hebard, l. c., pl. 10, fig. 1); a right phallomere sharp, elongate, spinelike, projecting. Subgenital plate (fig. 34) with right lateral portion abruptly curved dorsally in a nearly vertical plane; left lateral portion less abruptly curved dorsally; apical margin with narrow, ventrally decurved flap; disk of subgenital plate broadly concave in posterior half; styles borne near base of apical flap; left style slightly tapering, extending ventrad of plate apically; right style broadly ovate, extending about on plane with plate, a prominent oblique ridge on ventral surface. Cerci as in *ramsdeni*.

Coloration. General color dark brown, with reddish tinge; eyes black; general color of face and occiput light reddish brown, blotched with dark between antennal sockets; ocellar spots and clypeus pale; palpi pale brown; antenna brown, pale reddish at base; coxae blackish brown over most of areas receiving femora in repose; external lateral flanges of coxae noticeably paler; remainder of legs uniformly dark brown except arolia and bases of claws, which are pale. Supraanal plate uniformly dark brown; subgenital plate brown, apical flap pale; cercus brown, grading to pale in apical fifth.

Measurements. Length of body 15 mm., of pronotum 5.8 mm., of tegmen 4.3 mm., of hind tibia 5.8 mm.; width of pronotum 7.5 mm., of tegmen 4.7 mm.

Female (allotype). Differing from male as follows: Ventral margins of hind femur each with six spurs; supraanal plate (fig. 37) more produced posteriorly than in male; subgenital plate as in female of *ramsdeni*.

Coloration. Same in general as that of male; abdomen very dark on apical segments; cerci darker than in male, with only a trace of pale at apices.

Measurements. Length of body 16 mm., of pronotum 5.8 mm., of tegmen 4.8 mm., of hind tibia 5.6 mm.; width of pronotum 7.6 mm., of tegmen 4.8 mm.

There is one female paratype that agrees essentially with the allotype. The apex of the supraanal plate is shallowly and broadly emarginate. The apical segments of the abdomen are not so dark as in the allotype, and the middle region of tergum 7 is blotched with pale orange. One male nymph and one female nymph, measuring 13. 5 mm. and 12 mm., respectively, in body length, are dark brown with legs paler. No wing or tegminal pads are present.

Type locality. Pico Turquino (south side), Oriente Province, Cuba.

Type. Museum of Comparative Zoölogy.

Paratype. U. S. National Museum, No. 54828.

The type, allotype, paratype, and two nymphs were all taken at type locality, 3,000–5,000 feet altitude, June 1936, by P. J. Darlington. The male nymph is deposited in the U. S. National Museum. The author is glad to name this species in honor of the veteran American entomologist, Nathan Banks, Curator of Entomology in the Museum of Comparative Zoölogy.

The Genus Symploce Hebard

Symploce Hebard, Trans. Amer. Ent. Soc., vol. 42, p. 355, 1916 (genotype, *Ischnoptera capitata* Saussure, by original designation).

This genus contains many species in the warmer regions throughout the world, but the eight species now recognized as American are all found in the West Indies. One of these, *hospes* (Perkins), occurs on the American mainland and in Hawaii as well, but in America at present *Symploce* is essentially West Indian. The male genitalia furnish the most important specific characters, and illustrations of these structures, for the eight West Indian species, have been given by Hebard (1916b) and Rehn and Hebard (1927). A ninth species is now added, this from the seacoast of Oriente Province, Cuba. The only previously recorded Cuban species is the genotype, *capitata*, but it is less closely related to the new species than is *jamaicana* (Rehn).

Symploce munda, new species

Fig. 39

The male of this species differs from *jamaicana* in the structure of terga 1, 9, and 10, and that of the subgenital plate.

Male (holotype). Of average size for the genus; interocular space narrower than distance between antennal sockets (about as 2.45 to 3.6); segment 4 of maxillary palpus slightly shorter than apical segment. Pronotum, tegmina, and legs essentially as in *jamaicana;* ulnar vein of wing with two complete and two incomplete rami. Tergum 1 with dense tuft of hairs on posterior half, projecting forward, similar to that of *jamaicana;* sparse, slender hairs arranged in an oblique row on each side of middle near base poorly developed, not so prominent as in *jamaicana.* Tergum 9 unspecialized (in *jamaicana* there is a dorsally projecting lip, bearing a comb of sparse, erect hairs). Supraanal plate similar in general form to that of *jamaicana,* but strongly bilobed apically, unspecialized basally (the apex in *jamaicana* is entire, broadly rounded, with a prominent raised lip at the base of the disk corresponding to that of tergum 9). Subgenital plate (fig. 39) with left style heavily sclerotized, somewhat concave in basal two-thirds in ventral view, the lateral margin briefly recurved, apical third slender, twisted to the left, about five coarse teeth on ventral margin; large apical plate on right slightly convex in ventral view, a blunt apical tooth curving toward left, its margin minutely serrate; right latero-posterior angle of main body of subgenital plate with sparse, short, bristly setae (in *jamaicana* the left style is different, the large right plate has an acute hook directed to the left, and there is no cluster of bristly spines as in *munda*).

Coloration. General color pale yellowish; eyes dark brown; ocellar spots pinkish; antenna light brown, paler at base; wide lateral and narrow anterior borders of pronotum and marginal field of tegmen washed with whitish; legs pale, slightly darker on tibiae, tarsi, spines, and spurs; a conspicuous, small, black blotch at base of each coxa; abdominal sterna 2–6 with similar blotches at each side, a small black dot associated with each blotch laterally; terga 1–7 progressively darker toward apex of abdomen, the last very dark brown, all with pale margins; terga 8–10 pale yellowish, disk of 10 (supraanal plate) yellow; subgenital plate pale except for dark setae and left style; cerci pale dorsally, all except apical segments divided into dark-brown basal half and pale apical half ventrally, apical segments all dark ventrally.

Measurements. Length of body 9 mm., of pronotum 2.4 mm., of tegmen 10.5 mm., of hind tibia 3.75 mm.; width of pronotum 3.4 mm.

Female (allotype). General form as in male; width of interocular space considerably narrower than distance between antennal sockets (about as 3.45 to 4.6); ulnar vein of wing with three complete and

four incomplete rami; apex of supraanal plate with narrow, V-shaped incision; apex of subgenital plate shallowly and very broadly concave.

Coloration. Differing from male as follows: Terga 4–7 conspicuously darker, pale posterior margins poorly developed but pale lateral borders conspicuous; supraanal plate whitish yellow except a dark-brown blotch on disk each side of middle; subgenital plate with wide lateral and apical whitish-yellow border and a dark blotch and dot on each side as in preceding sterna; cercus uniformly blackish brown dorsally, same ventrally except that segments in basal two-thirds are somewhat pale in their apical portions.

Measurements. Length of body 10.5 mm., of pronotum 3.3 mm., of tegmen 13 mm., of hind tibia 5.2 mm.; width of pronotum 4.3 mm.

In addition to the type and allotype just described, there is one male paratype. It is smaller than the type and differs otherwise as follows: Width of interocular area in proportion to distance between antennal sockets as 2.9 to 3.4; ulnar vein of left and right wings with two incomplete and one incomplete rami, and one complete and one incomplete rami, respectively. Subgenital plate with left style more prolonged and conically tapering at apex, rather than twisted and flattened, without teeth; apical hook of large right plate less blunt than in type; group of spinelike setae constituting a much larger and denser cluster.

Measurements. Length of body 7.5 mm., of pronotum 2.3 mm., of tegmen 8.5 mm., of hind tibia 3.4 mm.; width of pronotum 2.9 mm.

Type locality. Coast below Pico Turquino, Oriente Province, Cuba.

Type. Museum of Comparative Zoölogy.

Paratype. U. S. National Museum, No. 54829.

The type and allotype were taken at the type locality, June 26–30, 1936, by P. J. Darlington. The paratype was collected by Dr. Darlington at Maisi, Oriente Province, July 17, 1936.

Subfamily BLATTINAE

The Genus Eurycotis Stål

Eurycotis Stål, Bihang K. Svenska Vet. Akad. Handl., Bd. 2, No. 13, p. 13, 1874 (genotype by monotypy, *Polyzosteria ruforittata* Brunner).

Eurycotis is richly represented in Cuba, 16 of the 22 West Indian species being known from that island. Of these 22 species, 14 were first described by Rehn and Hebard (1927) or have since been discovered, indicating that others may yet remain unknown to science. The keys, descriptions, and illustrations by Rehn and Hebard, together with

those of the present paper, should permit the identification of most specimens, and a fuller treatment of the genus does not seem timely until it is possible to consider the species belonging to the North, Central, and South American faunas. Until that time, the limits of the genus must remain uncertain, as indicated by Rehn and Hebard (1. c.). The generic key of those authors and that of Shelford (1910) suffice for identification purposes. The former authors mention 4 apparently natural groups into which the West Indian species may be divided. Of the 16 Cuban species, all except 5 (*lacernata, rhodae, opaca, taurus, cribosa*) belong to the group of "species of glabrous or shining, almost impunctate surface, with tegmina lateral or quadrate, but not attingent, largely with variegated color pattern."

It should be noted that *Blatta guttata* Thunberg, described from St. Bartholomew, is possibly a species of *Eurycotis* (see Rehn and Hebard, 1. c., p. 159) and that *Periplaneta occidentalis* Sauss. has been removed from *Eurycotis*, where it was placed by Shelford (1910, p. 12), to *Pelmatosilpha* (see Rehn and Hebard, 1. c., p. 15).

Key to the West Indian Species of Eurycotis

1. Tegmina with inner margins attingent or overlapping 2
   Tegmina with inner margins well separated 6
2. Entire dorsal surface of body and tegmina pitch black; male supraanal plate (fig. 18) with apical angles spiniform, recurved; female supraanal plate (fig. 17) transverse, broadly emarginate; spiniform postero-lateral production of tergum 7 with a lamella on inner side (fig. 2). (Cuba) . . . . . *taurus* Rehn and Hebard
   Entire dorsal surface of body and tegmina not pitch black, if light areas of pronotum are indistinct (some specimens of *opaca*) the supraanal plate differing in each sex (fig. 14, 16) from above; spiniform process of tergum 7 without an inner lamella or (in *opaca*, fig. 5) with this poorly developed 3
3. Body shining dark brown or black, pale lateral margins (fig. 1) extending onto base of tergum 6. (Cuba) . . . . *rhodae*, new species
   Body not colored as above 4
4. Tegmina extending to tergum 1 or slightly beyond, as long as wide 5
   Tegmina not reaching tergum 1, much wider than long. (Thorax with orange lateral borders, sometimes poorly differentiated.) (See figs. 5, 14, 16) (Cuba and Isle of Pines) . . . *opaca* (Brunner)
5. Abdomen with a pale dorsal border extending along each lateral margin; tegmen subquadrate. (Virgin Islands) . *improcera* Rehn

Abdomen without pale border along lateral margins; apex of tegmen oblique. (Antigua) ..... *similis* Caudell

6. Pronotum and dorsal surface of abdomen entirely dark. (In some species the hind tibia is expanded laterally about midway of its length, and with a conspicuous depression as in fig. 4.) 7

Neither pronotum nor abdomen entirely dark 10

7. Tegmen conspicuously yellow 8

Tegmen entirely dark 9

8. Hind tibia expanded laterally and with a conspicuous depression similar to that of *tibialis* (fig. 4). (Cuba)[1]

flavipennis Saussure and Zehntner

Hind tibia not so specialized. (Apical abdominal terga closely and heavily punctate; first segment of tarsus with pulvillus three-fourths the ventral length of segment.) (Cuba)

cribosa Rehn and Hebard

9. Male supraanal plate (fig. 10) well produced, though transverse; male tegmen (fig. 20) rounded at apex; hind tibia in each sex expanded laterally about midway of its length, and with a conspicuous depression (fig. 4). (Hispaniola) ..... *tibialis* Hebard

Male supraanal plate (fig. 12) very decidedly transverse; male tegmen (fig. 15) acute at apex; hind tibia of female broad, but not specialized as above. (Hind tibia of male specialized.) (Jamaica)[2] ..... *lixa* Rehn

10. Pronotum uniformly pale (except for scattered dark flecks), no conspicuous dark pattern 11

Pronotum not uniformly pale 14

11. Apical five terga of abdomen entirely dark in color 12

Apex of abdomen not entirely dark (tegmen subquadrate; supraanal plate transverse in male, bicolored). (Cuba)

galeoides Rehn and Hebard

12. Exposed portion of tegmen clearly transverse; tegmina separated by less than the width of a tegmen. (Cuba) .. *caraibea* (Bolivar)

Exposed portion of tegmen lobiform, not transverse; area between tegmina usually wider than the width of a tegmen 13

13. Abdominal terga 2–5 heavily marked with dark at their bases, the dark areas ending abruptly before reaching lateral margins and, at their farthest extension laterad, covering about three-fourths

[1] *E. flavipennis* S. & Z. is known only from the original description, and, following Rehn and Hebard (l. c., p. 179), the present interpretation of the unsatisfactory description had best be retained until further information is available.

[2] *E. lixa* Rehn is based upon two specimens, male and female, taken at New York City on a banana ship from Jamaica. For this reason, Jamaica is considered the native home of *lixa*.

the length of segment, narrowed each side of median line. (Cuba) ..... *scalaris* Rehn and Hebard

Abdominal terga 2–5 with narrow dark basal margins, these often indistinct. (Cuba) ..... *dimidiata* (Bolivar)

14. Pronotum with a definite dark design on the disk, such as in figs. 7–9 16

Pronotum without definite design on disk such as above, but sometimes with pale lateral borders 15

15. A dark species with a striking pale longitudinal band extending from head to middle of abdominal tergum 6 on each lateral margin, closely resembling *rhodae* (fig. 1) except that tegmina are lateral and widely separated; no transverse bars on abdomen. (Cuba) ..... *lacernata* Cabrera

A dark species with lateral borders of pronotum mars orange, this coloring not extending onto metanotum or abdomen; terga 2–7 with narrow basal transverse bars of mikado brown. (Hispaniola) ..... *histrio* Rehn

16. Head with a transverse, dark interocular bar (fig. 19), not with a triangular point extending ventrally to level of antennal bases or onto face 17

Head with a dark interocular marking extending triangularly to level of antennal bases (fig. 21) or onto face 20

17. Dorsal surface of abdomen entirely dark except for lateral maculations on terga 2–6, no transverse bars; basal segment of hind tarsus with pulvillus about two-thirds as long as segment. (Bahamas) ..... *bahamensis* Rehn

Dorsal surface of abdomen marked with transverse bars; basal segment of hind tarsus with pulvillus not over one-half as long as segment 18

18. Abdominal tergum 6 and supraanal plate uniformly dark; tegmen subquadrate, the nearly straight inner margin angulate with apical margin. (Cuba) ..... *balteata* Cabrera

Tergum 6 not entirely dark, supraanal plate often reddish brown or pale on apical two-thirds; tegmen not subquadrate, inner and apical margins continuous instead of angulate 19

19. Tegmen narrowly lobiform (fig. 8); pronotum with paired dark crescent-shaped marks. (Cuba) ..... *fugacis*, new species

Tegmen broadly lobiform, shaped much like tegmen of *caudellana* (fig. 9); pronotal pattern horseshoe shaped, with inner margins of dark design irregular. (Cuba)

ferrum-equinum Rehn and Hebard

20. Abdominal terga 1–5 transversely bordered with dark both anteriorly and posteriorly, the dark bars united before reaching lateral margins, a large pale submarginal maculation on each lateral border of terga 2–5 (fig. 9); dark posterior border of pronotum joined to dark blotches on disk. (Cuba)
caudellana, new species

Abdomen not marked as above; dark posterior border of pronotum, if developed, not joined to dark blotches on disk 21

21. Tegmen subquadrate; dark interocular marking extending ventrally to a level with ventral margin of antennal sockets, sides of triangular marking irregular. (Cuba)
torquincusis Rehn and Hebard

Tegmen lobiform (fig. 7); dark interocular marking with apex not extending ventrally beyond level of dorsal margins of antennal sockets, sides of triangular marking smooth. (Cuba)
famelica, new species

Eurycotis rhodae, new species

Fig. 1

This species is closely related to *lacernata*, which apparently replaces *rhodae* in western Cuba. The coloration of *rhodae* is so striking that the general appearance distinguishes it from all other known species. From *lacernata* it differs in the considerably larger size, in the exposed portions of the tegmina being transverse and slightly overlapping instead of lateral, and shaped much as in *caudellana* (fig. 9), in the lateral margins of the female supraanal plate converging less posteriorly, and in the color of the ventral surface of the abdomen, in addition to the more minor features noted below.

Female (holotype). Body smooth, shining; tegmina weakly impunctate. Head in frontal view slightly longer than wide, a little longer proportionately than in a female paratype of *lacernata:* interocular space noticeably wider than distance between antennal sockets. Anterior margin of pronotum briefly truncate directly above occiput, latero-anterior angles broadly rounded and depressed hoodlike about eyes. Tegmina subquadrate, exposed portions transverse, overlapping, extending posteriorly about one-fourth to one-third length of metanotum. Legs essentially as in *lacernata;* hind tibia moderately inflated, slightly less so than in *lacernata*, surface smooth; pulvillus of basal segment of hind tarsus less than one-fourth as long as segment. Abdomen with latero-posterior angles of terga 2–7 acute, those of tergum

7 very prolonged, with no inner lamella such as in *taurus* and *opaca* (figs. 2, 5); abdominal sterna similar to those of *lacernata;* supraanal plate wider at base than long, sides less converging than in *lacernata,* and latero-posterior angles well rounded in contrast to abruptly right-angled or slightly acute-angled as in *lacernata;* apical emargination broadly obtuse-angulate. Cerci slender, acuminate (right cercus with apex deformed).

Coloration. Pronotum with disk black, on posterior half an indistinct V-shaped mark of reddish brown with apex pointing forward and sides closely appressed, also a few dots of the same color showing through ground color of black; broad lateral borders of yellow as in fig. 1; margins dark brown, progressively intense anteriorly along lateral margins. Head with interocular area of dark brown, extending further posteriorly than in *lacernata,* reaching well onto occiput; a brownish transverse band connecting ventral margins of antennal sockets and joined with subquadrate ventral extension of interocular marking; region of fronto-clypeal suture pale brown, darker at frontal pits, joined to transverse facial band by a narrow longitudinal stripe, a single large brown dot on each side of median stripe at ventral margin of transverse band. (See Rehn and Hebard, 1927, pl. 12, fig. 7, for head coloration of *lacernata.*) Eyes dark; antennae pale brown. Tegmen brownish black, on inner five-eighths tinged with reddish, especially on inner posterior region; lateral border yellow, edged laterally with brown. Legs generally pale; lineate area at base of each coxa, dorsal margin of each femur, especially the ventral margins of hind femur in apical half, inner margin of middle tibia, spines, apices of claws, and apical portions of tarsal segments varying shades of brown; posterior tibia and tarsus dark brown, arolium, pulvilli, and base of claws paler. Dorsum of abdomen glossy black; four spots of reddish brown indicated on metanotum; posterior margin of terga reddish brown in reflected light; apical portion of supraanal plate and cerci reddish brown, apex of cercus pale; a broad yellow lateral border on terga 2–5 and at base of tergum 6, this pale border having a somewhat narrower counterpart on ventral surface of abdomen, which otherwise is uniformly black. (The venter of the female paratype of *lacernata* is light reddish brown, with a pale border.)

Measurements. Length of body 29 mm., of pronotum 7.8 mm., of tegmen 4.5 mm., of hind tibia 11.5 mm.; width of pronotum 11.5 mm., of tegmen 7.5 mm.

Type locality. Pico Turquino (south side), Oriente Province, Cuba.

Type. Museum of Comparative Zoölogy.

The only known specimen, the female type, was collected by P. J. Darlington in June 1936, at an altitude of 3,000–5,000 feet. This attractive species is named in honor of Mrs. Rhoda Frank Mislove, of the U. S. National Museum, who has assisted the writer in the preparation of many Orthoptera for study.

Eurycotis torquinensis Rehn and Hebard

Figs. 6, 11

Eurycotis torquinensis Rehn and Hebard, Bull. Amer. Mus. Nat. Hist., vol. 54, art. 1, pp. 163–165, pl. 12, figs. 9–12.

Material here recorded. 1 male, 8 females, 3 nymphal females, Pico Turquino (south side), Oriente Province, 3,000–5,000 feet, June 1936; 1 female, 2 nymphal females, same data except altitude, 5,000–6,000 feet (P. J. Darlington) (M. C. Z. and U. S. N. M.).

The above male has been compared with the only previously known specimen, the male holotype, and found to agree except in features ascribable to individual variation. In two specimens the pronotal marking agrees with that of the holotype, but the two dark lanceolate blotches of the disk are connected anteriorly by a short transverse bar in the other specimens. The middle area of tergum **7** has a pale-brown blotch in four specimens. In the female taken at 5,000–6,000 feet the dark area of the face is connected with the fronto-clypeal bar; the head coloration of the other specimens is about as figured by Rehn and Hebard (l. c., pl. 12, fig. 10). The venter of the abdomen is variable in color. The sterna of the male are dark brown except for pale lateral borders on all except the subgenital plate and penultimate sternum, the pale borders extending a short way along the posterior margins. The venter of the female varies from entirely pale except for the subgenital plate and penultimate sternum, which are brown, to a condition in which all sterna are considerably marked with dark brown. The basal sterna may be pale, with a small dark blotch on each lateral border. The penultimate sternum of most specimens is chestnut brown, marked with adjoining irregular, blackish-brown and pale bars on each lateral border. Rehn and Hebard (l. c., p. 170) have described similar variation in the coloration of the venter of *ferrum-equinum*. Females agree with the male in the essential details of tegmina, interocular width, legs, and other features. The female subgenital plate is typical of this section of the genus, and the supraanal plate (fig. 16) is as illustrated. The specimen from the 5,000–6,000 foot level is smaller than the others. Measurements in millimeters of

this and those of an average female from the 3,000–5,000 foot level are as follows: Length of body 18.5, 22; of pronotum 6.1, 6.9; of tegmen 2.4, 3.3; of hind tibia 8, 9; width of pronotum 8.4, 10. The nymphs range from 12 to 19 mm. in length. A pale border surrounds the pronotum anteriorly and laterally and extends back to the apex of tergum 5. The hind tibiae and tarsi are dark brown.

Eurycotis famelica, new species

Figs. 7, 21

This new species is a close relative of *balteata* but differs from that species in several distinctive color features and in slight, but none the less evident, structural features in tegminal shape.

Female (holotype). Size medium for genus; body very smooth and shiny. Head about as wide as long in frontal view (fig. 21). Hind tibia noticeably swollen, not flattened as in *ferrum-equinum* but agreeing essentially with *balteata* (see Rehn and Hebard, l. c., p. 166, pl. 12, fig. 14) except that it is more narrowed near base than there figured. Front and middle tibiae slightly swollen. Pulvillus of basal segment of hind tarsus one-fifth the ventral length of segment. Nota and abdominal segments typical of this section of the genus. Tegmen obtuse-angulate at junction of inner and apical margins. Supraanal plate about as described in *caudellana*. Subgenital plate and cerci as in that species.

Coloration. Head with irregularly margined, triangular, interocular marking of dark brown as illustrated (fig. 21); face and clypeus weakly marked with pale brown. Pronotal markings brownish black, the margins reddish brown. Legs nearly uniformly pale except for brown spines; middle and hind coxae each with a moderately weak, oblique brown line near base; dorsal margins of middle and hind femora, apex and base of hind tibia, and hind tarsus washed with pale brown. Tegmen with inner margin bordered with brown. Markings of terga 1–9 blackish tinged with reddish, especially along margins. Supraanal plate reddish brown, darker at base; cerci brown. Abdominal sterna brown, a wide lateral pale border on segments 2–6.

Measurements. Length of body 23 mm., of pronotum 6.5 mm., of tegmen 3 mm., of hind tibia 9.5 mm.; width of pronotum 10.3 mm.

Type locality. Loma del Gato, Cobre Range, Oriente Province, Cuba.

Type. Museum of Comparative Zoölogy.

The type female was taken July 3–7, 1936, by P. J. Darlington at an altitude of about 3,000 feet. In addition to the type, there is a nymphal

male 12 mm. long with the same data. The dorsal surface of the body is dark brown, a continuous pale border including the cerci. The posterior half of the pronotal disk and middle areas of the meso- and metanotum are of a lighter shade of brown than the general ground color.

Eurycotis fugacis, new species

Figs. 3, 8, 13, 19

This species is related to *balteata*, from which it differs in the shape of the tegmina and the inflation of the hind tibiae in both sexes, and in the shape of the male supraanal plate. The male genitalia of *balteata* have not been compared with those of *fugacis*, but differences probably occur. The most conspicuous difference in coloration is found on the pronotum. In *fugacis* (fig. 8) there are two curved marks roughly resembling parentheses, while *balteata* (see Rehn and Hebard, 1. c., pl. 13, fig. 1) has two broad lanceolate blotches. Tergum 6 of *fugacis* is not entirely dark, the tegmen has a border of brown along the inner margin, the anterior margin of the metanotum is pale, and the venter of the abdomen is pale except for the subgenital plate and the middle portions of the four sterna preceding it (sternum 8 all dark in male). In contrast, tergum 6 of *balteata* is entirely dark, the tegmen is merely margined with brown, the anterior margin of the metanotum has a large dark spot at each side near the meso-posterior portion of the corresponding tegmen, and the venter of the abdomen is solidly dark except that the five basal sterna have lateral yellow spots.

Male (holotype). General form as in female (fig. 3); head relatively broad, about as wide as long (fig. 19). Tegmen narrowly lobiform as in female. Hind tibia flattened, similar to that of *ferrum-equinum*. Pulvillus of basal segment of hind tarsus nearly one-half ventral length of segment. Supraanal plate (abnormal, owing to injury) (fig. 13) transverse, broadly bilobed apically. Subgenital plate (also abnormal) transverse, apparently typical for this section of the genus. Left phallomere of concealed genitalia similar to that of *torquinensis* (Rehn and Hebard, 1. c., pl. 12, fig. 11), flattened, slender, recurved at apex; no such hook present as in *torquinensis* just dorsad of subgenital plate on right side (1. c., pl. 12, fig. 12), but that sclerite simple; a complicated right phallomere (fig. 3) in form of a lamellate triangular hook with an associated, rather convex, recurved plate at base, this phallomere differing from the corresponding structure in *torquinensis* (fig. 6).

Coloration. Head with interocular bar of blackish brown (fig. 19); region between antennal sockets and along fronto-clypeal suture tinged

with pale brown; eyes black. Dorsal body and tegminal markings of blackish brown on yellow ground color as in female (fig. 8) except as noted; each parenthesis-shaped mark on disk of pronotum interrupted with pale brown one-third distance from anterior extremity; dark posterior borders of mesonotum, metanotum, and abdominal terga rather more intense in coloration; tergum 7 with narrow pale anterior border. Hind tibia brown, paler near spurs; hind tarsus washed with brown, darkest near apices of segments; each coxa marked with brownish black near base; margins of hind femur and spurs brown; the other leg structures pale. Subgenital plate and penultimate sternum brown; sterna 6 and 7 with middle area brown, with pale lateral borders; other sterna pale except for brown posterior and lateral margins. Supraanal plate blackish brown, blotched transversely across middle with reddish brown. Cercus dark brown above, more reddish in basal half, and with a subapical pale spot, ventral surface similar.

Measurements. Length of body 21 mm., of pronotum 6.5 mm., of tegmen 2.8 mm., of hind tibia 8 mm.; width of pronotum 9.8 mm.

Female (allotype). Agreeing with male in all important features except as noted. Interocular area slightly wider than in male. Supraanal plate as illustrated (fig. 8), apical margin (slightly asymmetrical as result of injury) sharply emarginate. Subgenital plate like those of related species, obtuse-angulate in lateral view.

Coloration. General color of body markings reddish brown. Parenthesis-shaped marks on pronotum not interrupted. Tergum 7 pale anteriorly only near lateral borders (probably with continuous anterior border when segments are more fully extended). Hind tibia with pale longitudinal stripe occupying lateral half of each side next to external margin, remainder pale brown. Penultimate sternum pale anteriorly on lateral border.

Measurements. Length of body 23 mm., of pronotum 6.7 mm., of tegmen 3 mm., of hind tibia 8.5 mm.; width of pronotum 10 mm.

Type locality. Buenos Aires, Trinidad Mts., Santa Clara Province, Cuba.

Type. Museum of Comparative Zoölogy.

The type and allotype were taken at an altitude of 2,500–3,500 feet, at the type locality, May 8–14, 1936, by P. J. Darlington.

Eurycotis ferrum-equinum Rehn and Hebard

Eurycotis ferrum-equinum Rehn and Hebard, Bull. Amer. Mus. Nat. Hist., vol. 54, art. 1, pp. 168–171, pl. 13, figs. 2–5.

Material here recorded. 1 female, 1 nymphal female, mountains

north of Imias, Oriente Province, 3,000–4,000 feet, July 25–28, 1936 (P. J. Darlington) (M. C. Z.).

Identification of the somewhat teneral adult has been confirmed by comparison with the types. The nymph, 10 mm. long, is pale at the apex of the abdomen, and the terga are obliquely pale bordered along the lateral margins. The thorax is bordered in a manner typical of the nymphs of this section of *Eurycotis*.

Eurycotis caudellana, new species

Fig. 9

The color pattern of *caudellana* is very distinctive, and the species should be identifiable by the foregoing key without difficulty; no other species closely resembles it. *Eurycotis scalaris* of eastern Cuba is suggestive of *caudellana* in the markings of the abdomen, but differs in other color features and in the shape of the tegmina.

Female (holotype). Medium to small for the genus; smooth and shining. Head in frontal view rather sharply triangular; interocular area but little wider than distance between antennal sockets. Hind tibia strongly inflated; pronotum and other legs typical of related species; pulvillus of basal segment of hind tarsus occupying no more than apical fourth of segment. Tegmen lateral, broadly rounded inner and apical margins without sign of angulation. Latero-posterior angles of abdominal terga about as in *rhodae;* supraanal plate with sides rather straight in apical two-thirds and converging strongly; apical angles slightly acute; apical emargination evenly and deeply rounded. Abdominal sterna typical of related species; subgenital plate obtuse-angulate in lateral view; cercus moderately broad, acuminate.

Coloration. Head generally pale; eyes black; interocular area dark brown, posterior margin irregularly excavate, ventral margin roughly triangular, extending to level of an imaginary line connecting middle of antennal sockets; slightly darker on clypeus and labrum; antenna light brown, pale at base. Pronotum marked with black as illustrated in fig. 9; two pale-brown dots on posterior half of disk; a wide lateral border of yellow; dark-brown lateral and apical margins. Meso- and metanotum and tegmina marked with dark reddish brown as illustrated. Legs generally pale; middle and hind femora each with oblique bar of dark brown basally; margins of middle and hind femora, all spines, apical and basal portions of hind tibia, and most of hind tarsus except pulvilli light brown. Terga yellow, marked with black tinged with reddish as illustrated; lateral margins brown; supraanal plate brownish toward apex; cercus reddish brown, darker along margins;

sterna brown, the posterior segments with pale lateral borders; subgenital plate somewhat darker at apex.

Measurements. Length of body (abdomen loosely attached) 21 mm., of pronotum 6 mm., of tegmen 2.4 mm., of hind tibia 12 mm.; width of pronotum 13.2 mm.

Type locality. Rio de Auras (about 65 miles southwest of Cardenas), near Union de Reyes, Matanzas Province, Cuba.

Type. U. S. National Museum, No. 54328.

The female holotype is the only known specimen.

Probably no entomologist more conscientiously devoted a large part of his life to a study of the literature of his favorite group of insects than did the late Andrew Nelson Caudell during the 35 years that Orthoptera and the literature concerning them were both his joy and his life work. Not privileged to know him personally, the writer appreciates Mr. Caudell's contributions, especially through the good fortune of having daily contact with the literature reference catalogue prepared by him. The present species is named *caudellana* in respect for his memory.

Eurycotis caraibea (Bolivar)

Polyzosteria caraibea Bolivar, Mém. Soc. Zool. France, vol. 1, p. 126, 1888.

Material here recorded. 1 male, Upper Ovando River, Oriente Province, 1,000–2,000 feet, July 17–20, 1936; 1 male, mountains north of Imias, Oriente Province, 3,000–4,000 feet, July 25–28, 1936 (P. J. Darlington); 1 male, introduced at Brainerd, Minn., July 1921. (M. C. Z. and U. S. N. M.)

Rehn and Hebard (1927, p. 178, pl. 14, figs. 3, 4) have given descriptive notes on this species. In the original description, based on a male, Bolivar gave the following length measurements: Body 21 mm., pronotum 7.5 mm., tegmen 3 mm. In the above three specimens the pronotum is 7.5 to 8 mm. long and the body length is 24, 24, and 30 mm., respectively, owing to different degrees of body extension. The Monte Libano male recorded by Rehn and Hebard has been examined; the genitalia agree with those of the specimens here recorded. The phallomeres include several genital hooks none of which resembles the right hooks of *fugacis* and *torquinensis* (figs. 3, 6).

Eurycotis taurus Rehn and Hebard

Figs. 2, 17, 18

Eurycotis taurus Rehn and Hebard, Bull. Amer. Mus. Nat. Hist., vol. 54, art. 1, pp. 182–185, pl. 14, figs. 5–8, 1927.

Material here recorded. 1 female, Coast below Pico Turquino, Oriente Province, June 26–30, 1936 (P. J. Darlington) (M. C. Z.).

Because of its size and pitch-black color, in addition to the distinctive features illustrated, this large species is not likely to be confused with any other. In the above-mentioned specimen there is a small, conspicuous spot of orange at each latero-anterior angle of the subgenital plate. Other features agree with the original description. Comparison with the type, allotype, and two paratypes has been made.

Subfamily EPILAMPRINAE

The Genus AUDREIA Shelford

Audreia Shelford, Gen. Insect., Fasc. 101, p. 11, 1910 (genotype, *Calolampra carinulata* Saussure, designated by Hebard, 1920, p. 92).

In addition to the two Cuban species separated in the following key, *Audreia* contains *jamaicana* R. & H., several species from the mainland of tropical America, and several Old World species that have been referred to this genus.

Key to the Cuban Species of Audreia

Tegmina attingent or slightly overlapping; each tegmen subquadrate, posterior margin oblique and usually concave; posterior margin of pronotum very broadly and obtusely angulate in middle
hamiltoni (Rehn)

Tegmina lateral; each tegmen (figs. 41, 43) lobate; posterior margin of pronotum truncate . . . . . *exploratrix*, new species

AUDREIA HAMILTONI (Rehn)

Calolampra hamiltoni Rehn, Trans. Amer. Ent. Soc., vol. 29, pp. 274–275, 1903.

Material here recorded. 1 male, 6 females, 4 nymphs, Pico Turquino (south side), Oriente Province, 3,000–5,000 feet, June 1936; 1 nymph, same, 5,000–6,000 feet, June 1936 (P. J. Darlington) (M. C. Z. and U. S. N. M.).

The above male agrees in general with that described by Rehn and Hebard (1927, p. 205, pl. 15), but the pronotal disk is shining black and no lyrate marking is evident. Projecting near the right style is a phallomere, long, flattened, hooked like a shepherd crook apically, the very tip curved laterally; about 20 minute lateral bristles basad of hooked portion.

Measurements. Length of body 16.5 mm., of pronotum 5.5 mm., of tegmen 5 mm., of hind tibia 6.7 mm.; width of pronotum 8 mm., of tegmen 5.5 mm.

The posterior margin of the pronotum varies from slightly to markedly concave in the females. The pronotal disk is very dark in all but one, which has the lyrate pattern well developed. Body length ranges from 19.5 to 23 mm. The nymphs range from 9 to 17 mm. in body length, and the pronotum has the dark disk and paler lateral borders characteristic of the species.

Audreia exploratrix, new species

Figs. 41–43

This is a close relative of *hamiltoni*, differing from that species in the color of the interocular and interocellar areas, in addition to the features mentioned in the key.

Male (holotype). Interocular area wider than distance between antennal sockets (as 4.7 to 4), slightly wider proportionately than in male of *hamiltoni*. Segments of maxillary palpus short; apical segment slightly less than twice as long as greatest width, length about equal to segment 3, slightly less than segment 4. Pronotum in cross section vaulted and domelike, somewhat as in *hamiltoni*, dorsal outline as in fig. 43; a shallow, transverse depression, about as long as distance between tegmina, on disk just in front of posterior margin of pronotum; the whole sparsely punctate. Tegmen as in fig. 43 in dorsal view, in dorso-lateral view inner-apical margin nearly straight-oblique, costal margin gently convex, venation about as in female paratype (fig. 41); wing vestigial, reaching nearly to apex of tegmen. Legs as in *hamiltoni*. Terga 2–7 with latero-posterior angles not spined, but rounded or subrectangular; longitudinal weltlike ridges present. Supraanal plate bilobed, moderately emarginate. Subgenital plate (fig. 42) asymmetrical, the styles slender and delicate, the left style not located so near apex of plate as in *hamiltoni* but this difference perhaps due to individual variation.

Coloration. General color dark brown, with areas of lighter color and mottling typical of this section of *Audreia*. Head in frontal view black from postclypeus to an imaginary transverse line bisecting interocular area (in *hamiltoni* the black color of face extending dorsally only slightly onto interocular area); occiput with light mottling, blotched with dark brown at base; eyes grayish black; cheeks pale brown; labrum and anteclypeus yellow; each ocellar spot and narrow

stripe extending to eye and thence along inner margin of eye to occiput pale; maxillary palpus brown, darker on segment 5; antenna brown, segment 2 paler. Pronotum with disk blackish brown, faintly tinged with red; a trace of lyrate marking in a dark longitudinal median mark on anterior half of disk; borders of yellowish orange, heavily spotted with dark brown.

Tegmen dark brown on inner two-thirds of basal half, reddish orange on narrow inner border and on inner portion of apical half, border along costal margin yellowish; the light areas with small dark blotches. Each coxa pale, dark brown at base, the surface receiving femur in repose darkly punctate; front femur nearly all brown, faces paler; middle and hind femora yellow, external margins, indefinite longitudinal facial stripes, and sockets of spurs on inner margins dark brown; front tibia mostly brown, blotched with pale near apex; middle and hind tibiae with brown and pale longitudinal streaks, darkest at bases of spurs; front tarsus mostly brown, pulvilli and bases of segments 1 and 5 pale; middle and hind tarsi mostly pale, dark in apical portions of segments, especially on lateral surfaces.

Dorsal surface of abdomen mottled much as in *hamiltoni*, but somewhat darker, pale areas more conspicuous toward apex; basal half of supraanal plate dark brown, a pale area in middle at base, apical half pale brown, sparse dark punctations; venter of abdomen uniformly very dark, shining brownish black; subgenital plate narrowly margined with light brown apically, styles pale. Dorsal surface of cercus brownish, pale at base; ventral surface brownish, apex darker.

Measurements. Length of body 18 mm., of pronotum 5 mm., of tegmen 3.6 mm., of hind tibia 5 mm.; width of pronotum 7.1 mm.

Female (allotype). Differing essentially from male as noted. Ratio of interocular area to distance between antennal sockets 5.6 to 4.5; pronotum with a broad, shallow depression on posterior half of disk; costal margin of tegmen less convex, only slightly convex in dorsolateral view; terga 2–7 with latero-posterior angles acute to spined, spines best developed on 5–7; supraanal plate more broadly rounded, weakly emarginate apically; subgenital plate evenly rounded apically, each lateral margin broadly concavo-emarginate opposite cercus as in *hamiltoni*.

Coloration. Much as in male, but considerably darker on dorsal surface of pronotum and tegmina; disk of pronotum with lighter borders reduced in size; tegmen blackish brown except basal three-fourths of costal margin, which is yellowish orange with sparse dark spots; tibiae and tarsi somewhat darker than in male; coxae, femora, and dor-

sum of abdomen about as in male; supraanal plate with a dark-brown elongate blotch in middle of basal half; lateral portions of basal half pale, with dark spots; apical half darker; subgenital plate uniformly dark; cereus dark brown, dorsal surface pale at base.

Measurements. Length of body 18 mm., of pronotum 5.7 mm., of tegmen 4.5 mm., of hind tibia 5.5 mm.; width of pronotum 8.5 mm.

There is one female paratype which agrees essentially with the allotype. The costal margin of the tegmen (fig. 41) is barely concave when seen in dorso-lateral view. The tegmen is colored about as in the male, the dorsum of the abdomen is rather darker than in the allotype, and the supraanal plate is all dark brown except for a few weakly developed orange spots at the base. The abdominal segments are more extended than in the allotype. Measurements. Length of body 23 mm., of pronotum 6.5 mm., of tegmen 5 mm., of hind tibia 7 mm.; width of pronotum 9 mm.

Type locality. Buenos Aires, Trinidad Mts., Santa Clara Province, Cuba.

Type. Museum of Comparative Zoölogy.

Paratype. U. S. National Museum, No. 54830.

The type, allotype, and paratype were taken at the type locality, 2,500–3,500 feet, May 8–14, 1936, by P. J. Darlington.

The Genus Epilampra Burmeister

Epilampra Burmeister, Handb. Ent., Bd. 2, Abt. 2 (1st half), p. 504, 1838 (genotype, *Blatta brasiliensis* Fabricius, designated by Kirby, 1903, p. 276).

There is considerable confusion in the literature concerning the genotype of *Epilampra* and its identity. Kirby's designation of *brasiliensis* appeared in August 1903, and in the same paper he designated *Epilampra nebulosa* Burm. as type of a new genus, *Pseudophoraspis*. In the following month Rehn (1903, p. 271) designated *nebulosa* as type of *Epilampra*. Kirby's action has priority. In his 1904 catalogue, however, Kirby gave *Blatta maculicollis* Serv. as type of *Epilampra*, placing *brasiliensis* as treated by Brunner (1865) and Burmeister (1838) in synonymy (the latter with a query), under the belief that the species called *brasiliensis* F. by Burmeister was misidentified. Shelford (1906, p. 276) has compared drawings in the Hope Museum at Oxford, prepared from Serville's specimens of *maculicollis* by Westwood, with Fabricius' type of *brasiliensis* in the Banksian cabinet of the British Museum, and he considers the two species distinct. Regardless of misidentification by Burmeister, which remains uncertain, the actual

brasiliensis of Fabricius is the genotype of *Epilampra* by Kirby's 1903 designation.

As pointed out by Hebard (1920) and Rehn and Hebard (1927), the limits of *Epilampra* and *Audreia* are poorly known and need thorough revision. Until that is done, the generic placement of *E. cubensis* Bol. is uncertain, and for the present this species is left in its original genus.

The present collection contains four of the five known Cuban species of *Epilampra*. Because of the comprehensive manner in which the group has been dealt with by Rehn and Hebard no key is presented here.

Epilampra cubensis Bolivar

Fig. 40

Epilampra cubensis Bolivar, Mém. Soc. Zool. France, vol. 1, p. 127, 1888.

Material here recorded. 1 female, Cuchillo de Guajimero (near Imias), Oriente Province, about 2,000 feet, July 25, 1936 (P. J. Darlington) (M. C. Z.).

This specimen is somewhat longer than indicated in Bolivar's description but otherwise agrees essentially. The general form is robust and suggestive of species of *Pelmatosilpha* though definitely epilamprine in its characters.

Gundlach (1890–91, p. 308) says that material of *cubensis* (very likely Bolivar's type material) came from Mata (about 10 miles southeast of Baracoa, Oriente Province).

Female. Head in frontal view as broad as long; width of interocular space and distance between antennal sockets subequal; face well filled, convex, with a weak, irregular, transverse depression between ventral margins of ocellar spots; apical segment of maxillary palpus with ventral margin broadly convex, length compared to segments 4 and 3 as 5 to 4 to 4; antenna normal for genus.

Pronotum not quite concealing occiput in dorsal view; point of greatest width near latero-posterior angles; posterior margin broadly and very obtusely angulate, barely concave on each side between middle and a point opposite anal sulcus of tegmen; dorsal surface smooth, moderately shining; disk with small depression on each side of middle corresponding to part of obscure lyrate pattern; front margin very narrowly marginate, gradually more widely so to latero-posterior angles, narrowed near base of costal margin of tegmen, then gradually widening again to middle of posterior margin. Tegmen (fig. 40) with venation as illustrated, marginate along costal margin, reaching about

to tergum 4. Wing poorly developed, reaching onto basal part of tergum 3, entirely covered by tegmen; venation well formed but wing probably non-functional, about 9 rami of ulnar vein visible. Legs typically epilamprine; middle region of front ventral margin of front femur with 4 subequal sturdy spines followed by about 12 tiny setalike spines and 2 genicular spurs; basal segment of hind tarsus longer than remaining segments; tarsal claws unspecialized; arolium of moderate size. Dorsal surface of abdomen flattened, shining; longitudinal welt-like ridges poorly developed but evident; latero-posterior angles of tergum 2 about right-angled; angles of terga 3–7 more acute, becoming sharply spiniform; supraanal plate deeply incised, broadly bilobed; cercus fairly slender, gradually tapering in apical half, acute at tip; sub-genital plate unspecialized, evenly rounded apically, each side broadly concave near base of cercus.

Coloration. Interocular space blackish brown, grading to dark chestnut on posterior part of occiput; blackish brown on face and postclypeus; a small chestnut blotch on front between ocellar spots; anteclypeus, labrum, most of mandibles, ocellar spots, margins of eyes, and area connecting each ocellar spot with corresponding eye pale; cheeks fuscous; eyes grayish black; maxillary palpus light brown, apical segment darker. Pronotum chestnut, slightly darker on posterior border; a few dark-brown spots on disk representing lyrate pattern. Tegmen chestnut; scapular and marginal fields lighter, mottled with rust-colored spots; a short black line in depression laterad of base of anal sulcus ("vena anali linea nigra apposita"—Bolivar).

Front coxa mostly pale, darker at base and on dorsal portion of surface receiving femur in repose; middle and hind coxae each averaging darker, punctate with black on surface receiving femur; front leg beyond coxa mostly fuscous, with pale streaks; middle and hind femora mostly yellowish, streaked with fuscous; middle tibia streaked with fuscous and yellowish, darker at bases of spurs; hind tibia very dark brown, spurs lighter; middle and hind tarsi mostly light fuscous, the basal segment of hind tarsus especially dark. Dorsum of abdomen brownish black, tinged with chestnut along lateral margins and on basal half of supraanal plate. Cercus pale, darker at apex. Venter of abdomen brownish black, the segments slightly margined laterally with chestnut and (in reflected light) with traces of paler posterior margins; subgenital plate dark, with lateral margins, a weak apical margin, and a small spot each side of middle on apical half light chestnut.

Measurements. Length of body 23 mm., of pronotum 7.4 mm., of tegmen 11 mm., of hind tibia 8.5 mm.; width of pronotum 9.6 mm., of tegmen 6.7 mm.

Epilampra tainana Rehn and Hebard

Epilampra tainana Rehn and Hebard, Bull. Amer. Mus. Nat. Hist., vol. 54, art. 1, pp. 213–216, pl. 16, figs. 9–11, 1927.

Material here recorded. 1 male, mountains north of Imias, Oriente Province, 3,000–4,000 feet, July 25–28, 1936 (P. J. Darlington) (M. C. Z.).

The male has previously been unknown, and the dorsal surface of this specimen is of a lighter color than the type series, and the abdomen is darker beneath, but agrees essentially in facial pattern and other features.

Male. Interocular area subequal to distance between ocellar spots and considerably narrower than distance between antennal sockets (as 2.4 to 3.4); apical segment of maxillary palpus three times as long as wide, noticeably longer than segment 4; supraanal plate extending well beyond subgenital plate, rather deeply incised and prominently bilobed apically; subgenital plate asymmetrical, a shallow concavity on apical margin to the left of middle, margin sinuate on right side posterior to right style.

Measurements. Length of body 18 mm., of pronotum 5.5 mm., of tegmen 20 mm., of hind tibia 7 mm.; width of pronotum 6.8 mm.

Epilampra gundlachi Rehn and Hebard

Epilampra gundlachi Rehn and Hebard, Bull. Amer. Mus. Nat. Hist., vol. 54, art. 1, pp. 223–225, pl. 17, figs. 4 and 5, pl. 18, figs. 1 and 2, 1927.

Material here recorded. 1 male, 2 females, mountains north of Imias, Oriente Province, 3,000–4,000 feet, July 25–28, 1936; 1 female, Gran Piedra Range (north of Daiquiri), Oriente Province, 2,000–3,000 feet, May 30–31, 1936 (P. J. Darlington) (M. C. Z. and U. S. N. M.).

The above male differs from the type, with which it has been compared, in having the tegmina longer, the pronotum somewhat darker, and the dark blotch on the subgenital plate smaller.

Measurements. Length of body 18 mm., of pronotum 4.7 mm., of tegmen 19.5 mm., of hind tibia 6.8 mm.; width of pronotum 6 mm.

Among the three females there is little variation. The interocular width is slightly greater than interocellar width and considerably less

than the distance between the antennal sockets. The Gran Piedra specimen has a dark transverse bar on the ventral part of the face, with two dark extensions, one at each end of the bar, onto the postclypeus. The venter of the abdomen in these specimens is sprinkled with fuscous. As in the male, there is a small premarginal dark blotch on each side near the base of each segment. The subgenital plate is similar to that of related species and, in addition to a sprinkling of fuscous, has four small, dark blotches on the basal part of the disk. The supraanal plate is bilobed apically, with a transverse dark mark subbasally.

Measurements of the Gran Piedra female: Length of body 18 mm., of pronotum 5.1 mm., of tegmen 22 mm., of hind tibia 7.5 mm.; width of pronotum 6.6 mm.

Epilampra burmeisteri (Guérin)

Blatta (*Phyllodromia*) *burmeisteri* Guérin, in La Sagra, Hist. Phys. Polit. Nat. Cuba, pp. 345–346, 1857.

Material here recorded. 1 female, Upper Ovando River (south of Cape Maisi), Oriente Province, 1,000–2,000 feet, July 17–20, 1936; 1 male, Yunque de Baracoa, Oriente Province, 1,000–1,800 feet, July 13, 1936; 1 male, Pico Turquino (south side), 3,000–5,000 feet, June 1936 (P. J. Darlington) (M. C. Z. and U. S. N. M.).

This species is especially distinguished by its small size and contrastingly colored tegmina with pale marginal and scapular fields and very dark basal portion of humeral trunk. The postclypeus of two of the above specimens is mostly dark. There is slight variation in the color of the face and interocular area, but there are no marked differences from the head illustrated by Rehn and Hebard (1927, pl. 17, fig. 6).

Measurements of the Turquino specimen. Length of body 14.5 mm., of pronotum 4.3 mm., of tegmen 16.5 mm., of hind tibia 5.7 mm.; width of pronotum 5.2 mm. The tegminal length of the Yunque de Baracoa specimen is 15 mm. and the body length 13.5 mm.

Epilampra species

Material here recorded. 1 nymph, Upper Ovando River, Oriente Province, 1,000–2,000 feet, July 17–20, 1936; 3 nymphs, mountains north of Imias, Oriente Province, 3,000–4,000 feet, July 25–28, 1936;

3 nymphs, Pico Turquino (south side), Oriente Province, 4,500–6,000 feet, June 18–20, 1936 (P. J. Darlington) (M. C. Z. and U. S. N. M.).

These specimens range from 6.5 mm. to 19 mm. in body length and cannot be identified to species with certainty.

Subfamily PANCHLORINAE

The Genus Pycnoscelus Scudder

Pycnoscelus Scudder, Bost. Journ. Nat. Hist., vol. 7, No. 3, p. 421, 1862 (genotype, *Pycnoscelus obscurus* Scudder (synonym of *Blatta surinamensis* L.), by monotypy).

Pycnoscelus surinamensis (Linnaeus)

Blatta surinamensis Linnaeus, Syst. Nat., ed. 10, p. 424, 1758.

Material here recorded. 1 female, Upper Ovando River, Oriente Province, 1,000–2,000 feet, July 17–20, 1936; 3 females, coast below Pico Turquino, Oriente Province, June 26–30, 1936 (P. J. Darlington); 1 male, 1 female, Bellevue, Antigua, Sept. 20, 1937 (H. E. Box); 1 male, Bangkok, Siam, March 1–24, 1932 (Hugh Smith). (M. C. Z. and U. S. N. M.).

It should be noted that this widespread tropical roach was first described by Linnaeus in 1758, and not in Edition 12 of the Systema Naturae as has been stated several times. It is rather remarkable that the genus *Pycnoscelus* was based upon an adventive immature female discovered in the hills of western Massachusetts. The author has not seen Scudder's unique type of the synonymous *obscurus*, but the description agrees so well with *surinamensis* nymphs of the same size (being very different from native New England *Parcoblatta*) that the correctness of the synonymy, generally accepted for many years, is evident.

The males of *surinamensis* are extremely rare and as far as the writer is aware were unknown from the New World until Davis (1919, p. 109) reported finding a male in the Reptile House of the New York Zoological Society. This may have been introduced from the Old World, however. If so, the Antigua specimen recorded above is the first American male. Hebard (1917, p. 194) has described a male from the Lesser Sunda Islands, and the two males in the National Museum agree with his description.

Blatchley (1920, p. 105), apparently not realizing that immature

female roaches may have styles on the subgenital plate preceding the final nymphal instar, says that it "passeth understanding" how the specimen of *obscurus* described by Scudder could be a female. Sharp (1895, p. 224) pointed out that young female roaches may have styles, and Quadri (1940, pp. 140–142) shows that female nymphs of *Periplaneta americana* (L.) have styles until the last instar preceding maturity. Other writers have also referred to the matter. Caudell (1925) described female nymphs of *surinamensis* and reported rearing experiments which showed that this species can and does produce young parthenogenetically and that the oöthecae are seldom extruded from the mother's body, the young usually being born alive.

This roach is of economic importance as intermediate host for Manson's eye worm (*Oxyspirura*) of poultry and many wild birds (see Shealy, 1927). It is also well known as a greenhouse pest in the northeastern part of the United States.

Subfamily BLABERINAE

The Genus Byrsotria Stål

Byrsotria Stål, Bihang Till K. Svenska Vet. Akad. Handlingar, Bd. 2, No. 13, p. 18, 1874 (genotype, *Blatta thunbergii* Guérin (synonym of *Blatta fumigata* Guérin), by monotypy).

Byrsotria cabrerai Rehn and Hebard

Byrsotria cabrerae Rehn and Hebard, Bull. Amer. Mus. Nat. Hist., vol. 54, art. 1, pp. 266–268, pl. 24, figs. 1 and 2, 1927.

Material here recorded. 1 male, 1 female, coast below Pico Turquino, Oriente Province, June 26–30, 1936 (P. J. Darlington) (M. C. Z.); 1 male, between Cardenas and Varadero, Matanzas Province, November 1931 (H. A. Pilsbry) (A. N. S. P.).

This species was named in honor of Senor Jose Cabrera, and, because of the rules regarding the formation of specific names derived from a man's name, it seems best to emend the original spelling, which may have been accidental, to *cabrerai*.

The wing and tegminal length are variable; the tegmina of the Turquino male only slightly surpass tergum 4, and the wings do not extend beyond tergum 2, while the tegmina of the male in the Philadelphia collections recorded above are of about the same length. This condition contrasts with that of the holotype, which has tegmina reaching onto tergum 7 and well developed wings.

Measurements in millimeters of the Turquino male and female, respectively, are as follows: Length of body 33, 44.5; of pronotum 10.5, 13.5; of tegmen 16.5, 12.3; of hind tibia 12, 15; width of pronotum 16.5, 23.

The male from Matanzas Province indicates that *cabrerai* occurs in western as well as eastern Cuba.

Subfamily CORYDIINAE

The Genus HOLOCOMPSA Burmeister

Holocompsa Burmeister, Handb. Ent., Bd. 2, Abt. 2 (1st Half), p. 491, 1838 (genotype, designated by Kirby, 1904, p. 169, *Corydia collaris* Burm. (synonym of *Blatta nitidula* F.).)

HOLOCOMPSA NITIDULA (Fabricius)

Blatta nitidula Fabricius, Species Insectorum, vol. 1, p. 345, 1781.

Material here recorded. 1 female, Loma del Gato, Cobra Range, Oriente Province, about 3,000 feet, July 3–7, 1936 (P. J. Darlington) (M. C. Z.).

With the pubescent, orange pronotum, and tegmen divided obliquely into bluish metallic and hyaline areas, the present specimen is typical of *nitidula*, the male of which has a blackish pronotum. This domiciliary species apparently occurs even in the higher Cuban mountains. The only other described West Indian species of *Holocompsa* is *metallica* R. & H. of Hispaniola.

The Genus PHOLADOBLATTA Rehn and Hebard

Pholadoblatta Rehn and Hebard, Bull. Amer. Mus. Nat. Hist., vol. 54, art. 1, p. 286, 1927 (genotype, *Aphlebia inusitata* Rehn, by original designation and by monotypy).

PHOLADOBLATTA INUSITATA (Rehn)

Fig. 33

Aphlebia inusitata Rehn, Bull. Amer. Nat. Hist., vol. 22, art. 5, p. 113, 1906.

Material here recorded. 1 male, Soledad[1] (near Cienfuegos), Santa Clara Province, May 1936 (P. J. Darlington) (M. C. Z.).

[1] See Barbour and Robinson (1940) for a general account of the laboratory of Harvard University located at Soledad.

This specimen differs from the type (Rehn and Hebard, 1927, pl. 20, fig. 6) in having the apical margin of the tegmen broadly and evenly rounded, thus agreeing with the Camoa specimen recorded by the latter authors. There is a well sclerotized, gently curved phallomere dorsad of the right half of the subgenital plate. The left style is directed ventro-posteriorly and is more elongate and gradually tapering than shown in fig. 33 on account of foreshortening.

Subfamily OXYHALOINAE

The Genus Plectoptera Saussure

Plectoptera Saussure, Mém. Hist. Nat. Mex., Mém. 4, p. 173, 1864, (genotype, designated by Rehn, 1903, p. 281, *Blatta porcellana* Saussure).

Of the 10 West Indian species of *Plectoptera* treated by Rehn and Hebard (1927), the following 4 occur in Cuba: *porcellana* (Sauss.), *vermiculata* R. & H., *lacerna* R. & H., and *poeyi* (Sauss.). Because the differences in color and in male genitalia were freely illustrated by Rehn and Hebard (l. c.), a key is not presented here.

Plectoptera porcellana (Saussure)

Plectoptera porcellana Saussure, Rev. at. Mag. Zool., Ser. 2, Vol. 14, p. 164, 1862.

Material here recorded. 2 males, Loma del Gato, Cobre Range, Oriente Province, about 3,000 feet, July 3–7, 1936; 1 male, 1 female, Pico Turquino, 5,000–6,000 feet, June 1936; 1 male, same (south side), 3,000–5,000 feet; 1 female, Buenos Aires, Trinidad Mts., Santa Clara Province, 2,500–3,500 feet, May 8–14, 1936 (P. J. Darlington) (M. C. Z. and U. S. N. M.).

In the color of head, pronotum, and tegmina and in the directions in which the appendages of the male subgenital plate are bent the variation in these specimens agrees with previous information about *porcellana*. It is of interest to find *porcellana* near the summit of Turquino, and it probably occurs throughout Cuba.

SUMMARY

This paper is a report on a collection of roaches made in Cuba during 1936 by P. J. Darlington. Sixteen genera are treated, and an attempt has been made to consider each comprehensively as far as Cuba is

concerned; in several cases the entire West Indian fauna or an entire genus is reviewed. A new subspecies of *Ischnoptera ligula* R. & H. is described and 9 new species, the latter in the genera *Neoblattella*, *Ischnoptera*, *Nelipophygus*, *Symploce*, *Eurycotis*, and *Audreia*. The consideration of *Eurycotis*, including a key to the 22 West Indian species, descriptions of 4 new species, and 2 plates of illustrations, is one of the more comprehensive sections of the report. Several species are discussed about which very little has previously been known. Variation has been considered important in the treatment of species, and the generic diagnosis of *Nelipophygus* has been modified so that a new species may be referred to that genus. A list of West Indian Blattidae described since 1927, when a revision by Rehn and Hebard appeared, has been compiled. Because of homonymy, a new specific name, *tepperana*, is given to *Blatta rufa* (Tepper) of Australia.

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EXPLANATION OF PLATES

PLATE 1

PLATE 1

Fig. 1. *Eurycotis rhodae*, new species, female. Dorsal view.
2. *E. taurus* R. & H., female. Dorsal view of latero-posterior process of tergum 7. Coast below Pico Turquino, Oriente Province, Cuba, June 26–30, 1936.
3. *E. fugacis*, new species, male. Ventro-mesal view of right phallomere.
4. *E. tibialis* Hebard, male. Ventral view of right hind tibia. Holotype.
5. *E. opaca* (Brunner), female. Dorsal view of latero-posterior process of tergum 7. San Diego de los Banos, Pinar del Rio Province, Cuba, April 22, 1900.
6. *E. torquinensis* R. & H., male. Same view as in fig. 3. Pico Turquino (south side), Oriente Province, Cuba, 3,000–5,000 feet, June 1936.
7. *E. famelica*, new species, female. Dorsal view.
8. *E. fugacis*, new species, female. Dorsal view.
9. *E. caudellana*, new species, female. Dorsal view.

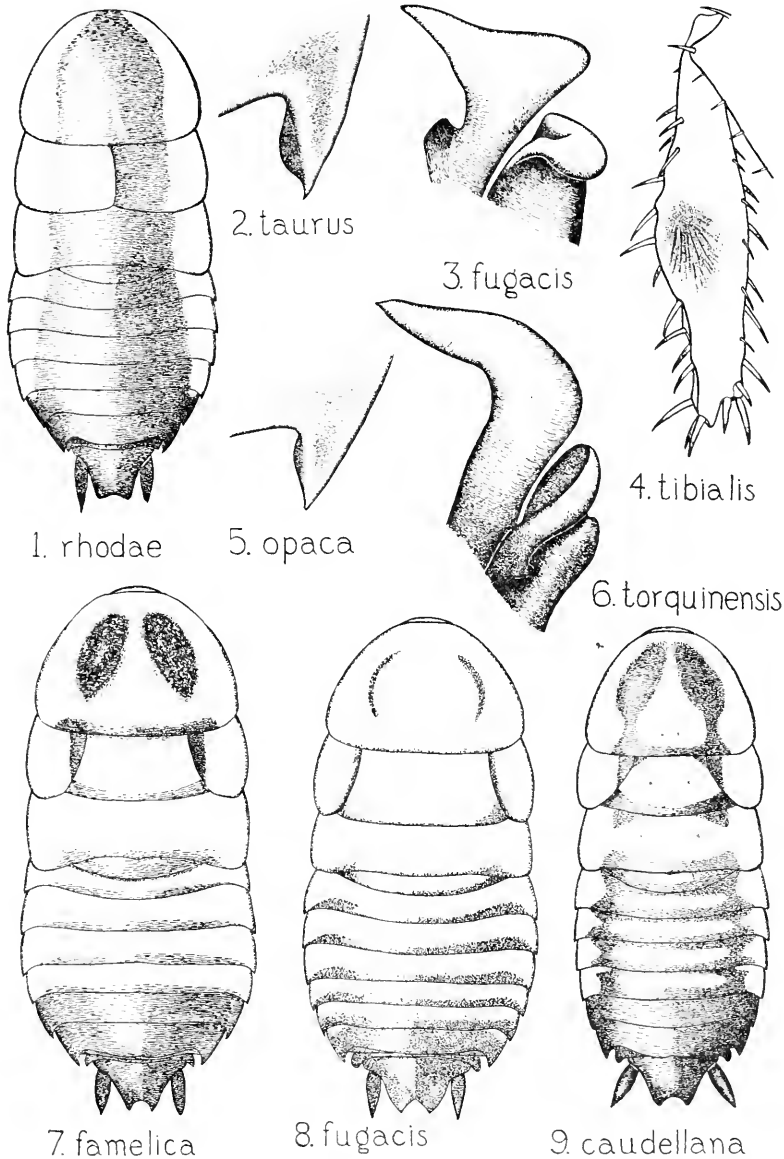

1. rhodae
2. taurus
3. fugacis
4. tibialis
5. opaca
6. torquinensis
7. famelica
8. fugacis
9. caudellana

PLATE 2

PLATE 2

Fig. 10. *Eurycotis tibialis* Hebard, Male. Dorsal view of supraanal plate Holotype.
11. *E. torquinensis* R. & H., female. Same view. Same data as in fig. 6.
12. *E. lixa* Rehn, male. Same view (after Rehn, 1930).
13. *E. fugacis*, new species, male. Same view (apex deformed).
14. *E. opaca* (Brunner), female. Same view. Same specimen as in fig. 5.
15. *E. lixa* Rehn, male. Dorsal view of left tegmen (after Rehn, 1930).
16. *E. opaca* (Brunner), male. Dorsal view of supraanal plate. Santiago de Las Vegas, Havana Province, Cuba, April 1905.
17. *E. taurus* R. & H., female. Same view. Same specimen as in fig. 2.
18. Same, male. Same view (after Rehn and Hebard, 1927).
19. *E. fugacis*, new species, male. Frontal view of head.
20. *E. tibialis* Hebard, male. Dorsal view of left tegmen. Holotype.
21. *E. famelica*, new species, female. Same view as in fig. 19.

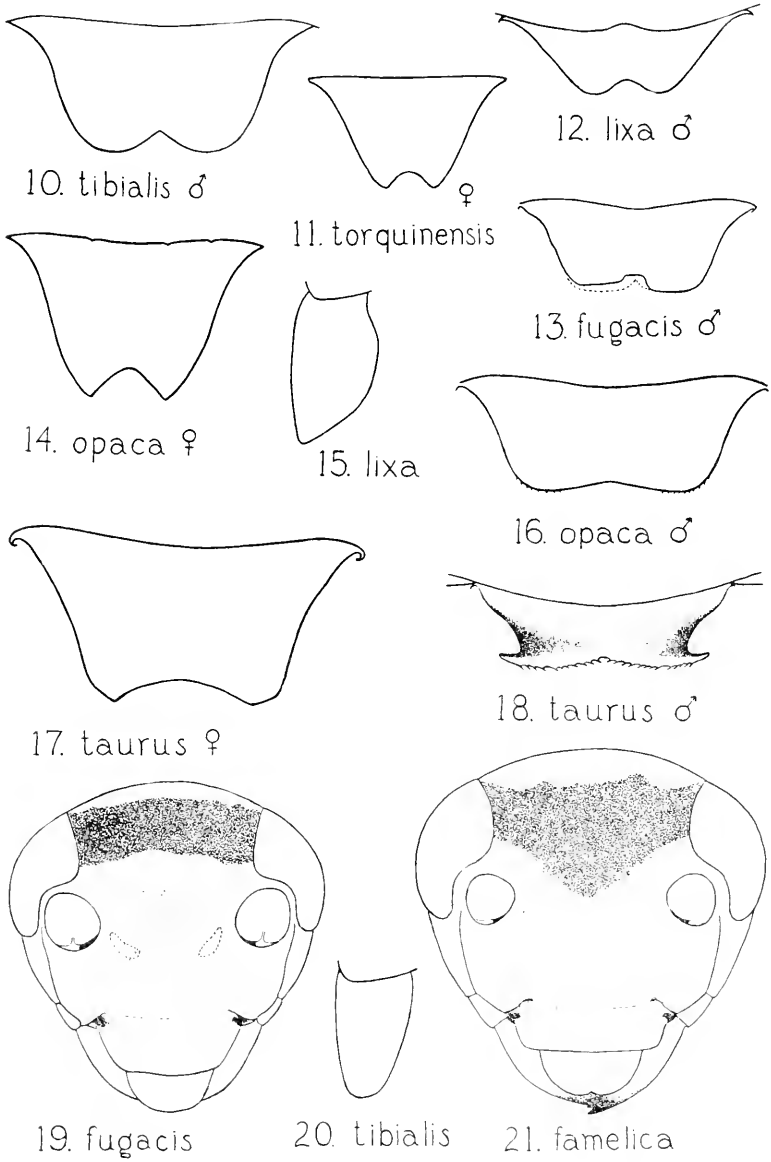

10. tibialis ♂
11. torquinensis ♀
12. lixa ♂
13. fugacis ♂
14. opaca ♀
15. lixa
16. opaca ♂
17. taurus ♀
18. taurus ♂
19. fugacis
20. tibialis
21. famelica

PLATE **3**

PLATE 3

Fig. 22. *Cariblattoides instigator* R. & H., male. Ventro-posterior view of subgenital plate. Gran Piedra Range, Oriente Province, Cuba, 2,000–3,000 feet, May 30–31, 1936.

23. Same, male. Same view. Mountains north of Imias, Oriente Province, Cuba, 3,000–4,000 feet, July 25–28, 1936.

24. *Aglaopteryx mira* Rehn, male. Ventral view of subgenital plate. Loma del Gato, Cobre Range, Oriente Province, Cuba, about 3,000 feet, July 3–7, 1936.

25. *Ischnoptera ligula collina*, new species, male. Dorsal view of supra-anal plate. Paratype from Loma del Gato.

26. Same, male. Dorso-posterior view of subgenital plate. Holotype.

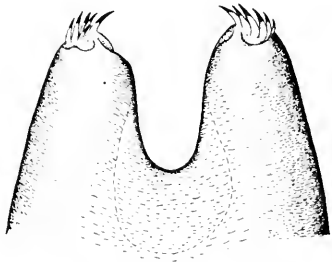
27. *I. darlingtoni*, new species, male. Dorso-posterior view, slightly from left side, of right style. Holotype.

28. Same, male. Posterior view, from left side, of left paraproct. Holotype.

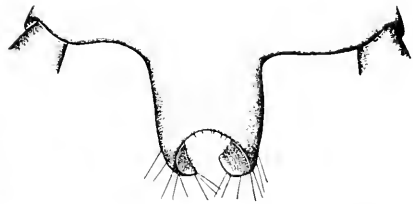
29. Same, male. Posterior view, from right side, of right paraproct. Holotype.

30. Same, male. Dorso-posterior view, slightly from left side, of subgenital plate. Holotype.

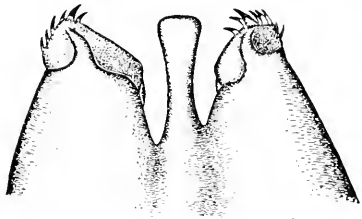
31. Same, male. Dorsal view of apex of abdomen. Holotype.



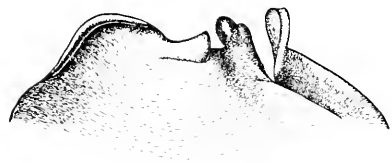
22. instigator



25. collina

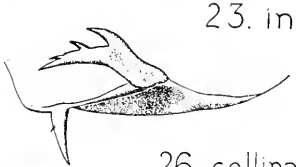


23. instigator



24. mira

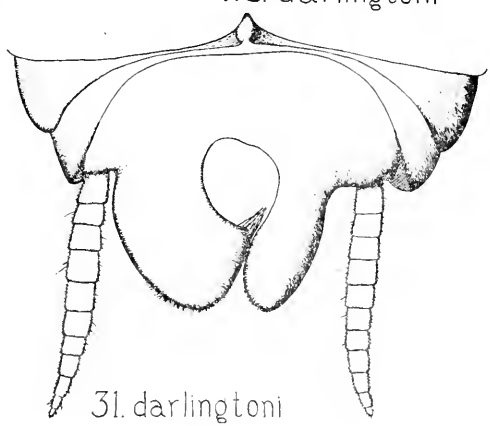
29. darlingtoni



26. collina

28. darlingtoni

27. darlingtoni



31. darlingtoni

30. darlingtoni

PLATE 4

PLATE 4

Fig. 32. *Neoblattella guanayara*, new species, male. Ventro-posterior view of subgenital plate. Holotype.

33. *Pholadoblatta inusitata* (Rehn), male. Ventro-posterior view of subgenital plate. Soledad (near Cienfuegos), Santa Clara Province, Cuba, May 1936.

34. *Nelipophygus banksi*, new species, male. Ventral view of subgenital plate. Holotype.

35. Same, male. Dorsal view of left tegmen. Holotype.

36. Same, male. Apical view of claws and associated structures of left hind tarsus. Holotype.

37. Same, female. Dorsal view of supraanal plate. Allotype.

38. *Neoblattella vatia* R. & H., male. Ventral view of subgenital plate. Pico Turquino (south side), Oriente Province, Cuba, 1,500 feet, June 25, 1936.

39. *Symploce munda*, new species, male. Ventral view, considerably from left side, of subgenital plate. Holotype.

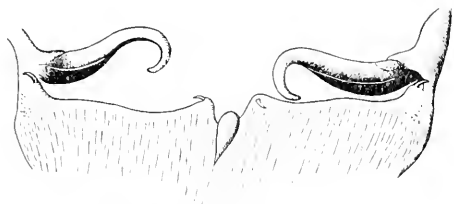
40. *Epilampra cubensis* Bolivar, female. Dorsal view of right tegmen. Cuchillo de Guajimero (near Imias), Oriente Province, Cuba, about 2,000 feet, July 25, 1936.

41. *Audrcia exploratrix*, new species, female. Dorsal view, from left side, of left tegmen. Paratype.

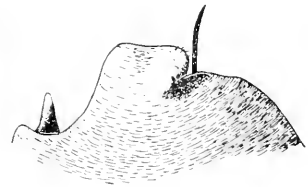
42. Same, male. Ventral view of subgenital plate. Holotype.

43. Same, male. Dorsal view. Holotype.

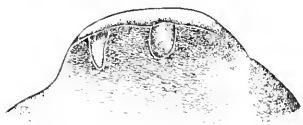
(All drawings by the author)



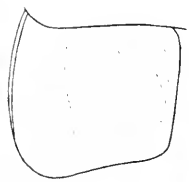
32. guanayara



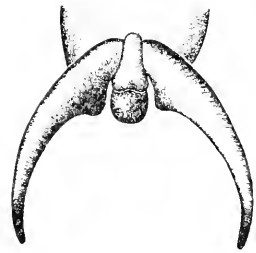
33. inusitata



34. banksi

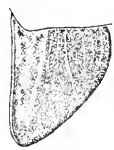


35. banksi



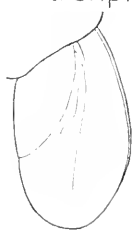
36. banksi

38. vatia

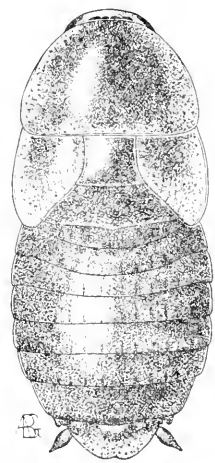


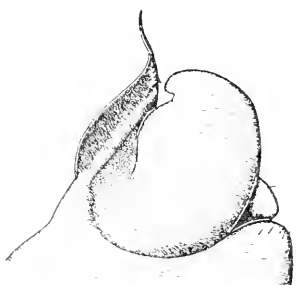
41. exploratrix

37. banksi ♀



40. cubensis





39. munda

42. exploratrix

43. exploratrix

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NOTES ON VARIOUS PEREGRINE EARTHWORMS

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CAMBRIDGE, MASS., U.S.A.
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No. 3.—*Notes on Various Peregrine Earthworms*

By G. E. Gates

TABLE OF CONTENTS

INTRODUCTION

The peregrine earthworms of tropical and subtropical regions have not received the attention due them because of their extensive distribution. The anatomy of many of the species is inadequately characterized and the taxonomic status of a number is uncertain.

A previous article (Gates, 1937) is concerned with the synonymy, local distribution and definition of the Pheretimas which have been imported into America from the Oriental region. In another article now in press some of the confusion prevailing with regard to the septal displacements in a pantropical form has been cleared up. The portion of the survey of non-Lumbricid, peregrine forms included in the present contribution is merely in the nature of a report on the material that could be obtained during the last five to six years. The study of one Ocnerodrilid species naturally led to an examination of one of the most difficult problems of Megadrilid systematics, that provided by the genus *Gordiodrilus*, and several suggestions as to a solution are advanced. Among other results of especial interest may be mentioned the presence in *Eudrilus eugeniae* (Kinberg) 1867, of supra-intestinal glands hitherto known only from three Megascolecid genera, and of "rolled tube" penial setae, hitherto recorded only from three Eudrilid genera, in a species of a Megascolecid genus, *Ramiella*.

The tendency in the past has been to regard a species as endemic in the area in which it is first found,[1] in spite of recognizing a tendency to transportation on the part of small-sized species, limited generic representation in the area concerned, and absence of those large species which are less likely to be successfully transported. Forty years or more without further records of distribution seem only to confirm the endemicity. Hence the description of new species and especially a new genus (of the Ocnerodrilidae) in an article on peregrine forms may at first seem rather surprising. The earthworm faunae of large areas of the world are very incompletely worked out, particularly those of the African and Neotropical regions, regarded as the main areas of Ocnerodrilid evolution. Earthworms are known to have been transported widely with frequent colonizations in new areas far from their original homes. In view of the fragmentary knowledge of so many large areas, the spasmodic, casual or superficial nature of most work on megadrilid faunae, it would be premature to conclude that more than a portion of the successful transportations have been recognized hitherto.

[1] Woodwardiellas, for instance, have been supposed to be endemic in South India and Ceylon, as also two species of *Eukerria* in Southern California, and species of *Pheretima* in Madagascar. Endemicity of three species of *Howascolex* and of two species of *Dichogaster* in South India may also be cited.

Admittedly transportation, as an explanation of the occurrence of two of the new Ocnerodrilid species in the regions in which they are now alone known, remains to be demonstrated. Nevertheless it is most probable that the new species of *Eukerria* is an importation into Burma, either directly or indirectly from South America. Endemicity of a species of *Gordiodrilus* or of *Woodwardiella* in a region including South India and Burma, or of a species of *Malabaria* in a region including Burma and Hainan Island, is highly improbable. In fact there is some justification for doubting endemicity of any Ocnerodrilid in any part of the Oriental region. Likewise there are good reasons for suspecting that the Oriental Woodwardiellas are importations from the Australasian region.

In these circumstances it seems to be preferable to label a species as probably or even only possibly peregrine, rather than spare the label and confuse zoogeographical discussion, particularly for the sake of those who may be quite unfamiliar with the difficulties involved in connection with the distributions of Megadrilids.

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FAMILY OCNERODRILIDAE

An anterior, pre-intestinal region of the body of earthworms always differs considerably from the intestinal portion. On passing from the intestinal to the pre-intestinal region, the function of the dorsal blood vessel changes from collection to distribution, while that of the ventral trunk changes from distribution to collection; segmental commissures are replaced in part at least by hearts, and other modifications of the vascular system are found, particularly in connection with the subneural system (when present) and the enteric plexi. The excretory system is likewise often modified in a larger or smaller portion of the pre-intestinal region. Calciferous tissues, often in special glands, are associated with the pre-intestinal region and a considerable portion of the gut in that region, if not all of the oesophagus is lined with cuticle.[1] The pre-intestinal region is also often characterized by an

[1] Cuticular secretion seems to be characteristic of ectoderm, and accordingly portions of the gut derived from the stomadeal and proctodeal invaginations may be expected to be lined with cuticle. But in species of *Pheretima* the cuticular lining of the oesophagus has been recognized into x, while in species of *Drawida* the lining has been found as far back as xxv. Although as yet undemonstrated in more posterior portions of the gut, there is a possibility that the cuticular lining extends to the hind end of the oesophagus. In these circumstances an ectodermal origin of the whole of the oesophagus from mouth to oesophageal valve perhaps requires consideration. An ectodermal origin for the whole of the oesophagus would be another distinguishing characteristic of the pre-intestinal region. If on the contrary the gut epithelium of the pre-intestinal region is not ectodermal, it is still distinguished from that of the intestine by its ability to secrete cuticle.

extra-oesophageal system of blood vessels, which may have somewhat of a portal nature, transporting blood between the skin and the calciferous section of the gut.

The pre-intestinal region varies in segmental extent and may include only the first eleven segments as in the Ocnerodrilidae, the anteriormost thirteen as in certain species of *Ramiella*, *Eudrilus*, and *Tonoscolex*, fourteen as in *Pheretima*, *Eutyphoeus* and a number of other Megascolecid genera, fifteen as in *Hoplochaetella*, sixteen as in *Nellogaster*, seventeen as in *Dichogaster*, *Notoscolex* (part) and *Megascolex* (part), eighteen as in *Notoscolex* (part), *Priodochaeta* and *Priodoscolex*, nineteen or twenty as in certain species of *Diplocardia*, more than twenty in the Moniligastridae.

Assuming that all earthworms have had a common origin, these variations may have resulted from (1) maintenance or reduction of a primitively extensive pre-intestinal region, (2) maintenance or extension of a primitively short region, or (3) simultaneous developments in different ways in different phylogenetic lines. The evidence available is insufficient to warrant much discussion of these possibilities at present. It may however be noted that there seems to be a tendency to extension of the pre-intestinal region in certain evolutionary lines, as for instance in the Megascolecinae and *Diplocardia*, also that Pickford regards the appearance of hearts in xiii as of recent and sporadic occurrence in Acanthodriline groups in which the original condition was three pairs in x–xii. Now if the tendency in the Megascolecidae (in Stephenson's sense) is to extension rather than reduction, the usual phylogenetic derivation of the Ocnerodrilidae from the Acanthodrilinae, as the last of the stems deriving from *Notiodrilus*, will be incorrect. It may be advisable to consider if the Ocnerodrilidae are not more primitive, at least in respect to the pre-intestinal region, than the supposedly ancestral Acanthodrilinae.

The distinguishing character of the Ocnerodrilidae, according to Stephenson, is the presence of an unpaired and ventral or paired calciferous sacs in ix or ix and x. Two genera are now known without such sacs. Much more characteristic, on the basis of the evidence now available, seems to be the short pre-intestinal region, with intestinal origin in xii and restriction of the latero-oesophageal hearts to x–xi.

Of the 44 Ocnerodrilid species recognized by Michaelsen in 1900, the diameter (presumably maximum) of five species is one mm., of fourteen species one to two mm., of nine species two mm., of one species between two and three mm., of one species three mm. Of the fourteen species with thickness unknown, the length is as follows: 15–38 mm.

(1 species), 15–35 mm. (2), 25 mm. (5), 25–50 mm. (1), 25–60 mm. (1), 40 mm. (2), 40–50 mm. (1), even length unknown (1). All of these species of unknown diameter probably are of about the same size as other forms. Of forms described since 1900, the single species of *Paulistus* and the two known species of *Kerriona* are, so far as can be discovered from the literature now available, the only exceptions to the general rule as to size in the family, and those three species are all South American endemics. Probably no earthworms are smaller than the Ocnerodrilids. So far then as size is concerned the Ocnerodrilidae, of all earthworm families, appear to be most favorably adapted for transportation in numbers sufficient to enable colonization when conditions of the new habitat are suitable.

In view of this small-size predisposition to transportation, it is necessary to be cautious in attributing endemicity to any Ocnerodrilid species in any area separated by sea from Africa or America, and even in portions of Africa itself as well as America. The occurrence of a supposed endemic of the "fairly archaic" *Eukerria* in South Africa was one of Michaelsen's reasons for believing that Africa rather than South America is the headquarters of Ocnerodrilid development. The South African form (*gunningi*) is now known to be peregrine, and actually is, according to Pickford, only *saltensis*. Other supposed endemics that might better be regarded as possibly if not probably peregrine are two species of *Eukerria* in Lower California, one species of *Ocnerodrilus* in Paraguay, species of *Gordiodrilus* in the Mediterranean region of Africa, species of *Maheina* in the Seychelles, species of *Gurgia* and *Malabaria* in India, species of *Gordiodrilus* in Madagascar.

According to Michaelsen's criteria of large and small-sized species versus small-sized species only, South America would appear to be of greater importance in Ocnerodrilid development than Africa. Or is the situation comparable to that of *Dichogaster*, which crossed the Atlantic Ocean from Central America into Africa to give rise to the giant forms that enable recognition of African endemicity and major development?

Genus EUKERRIA Michaelsen 1935

EUKERRIA PEGUANA spec. nov.

Material examined. From Burmese collections:

Rangoon, Hanthawaddy district, February, 3 clitellate specimens; June, 53 juvenile or aclitellate specimens and 1 partially clitellate specimen; July, 89 juvenile or aclitellate specimens; August, 11 clitellate specimens. K. John.

Kungyangon, Hanthawaddy district, September, 4 clitellate specimens. K. John.

Thongwa, Hanthawaddy district, September, 1 clitellate specimen. K. John.

Moulmein, Amherst district, October, 2 aclitellate and 3 clitellate specimens. K. John.

Pegu, Pegu district, August, 3 clitellate specimens. K. John.

Wanetchaung, Insein district, September, 1 clitellate specimen. K. John.

Myaungmya, Myaungmya district, October, 1 aclitellate, 1 partially clitellate and 4 clitellate specimens. Maung Chn Maung.

Pyinmana, Yamethin district, October, 3 clitellate specimens. K. John.

External characteristics. Length 20–50 mm. Diameter ¾–1 mm. Unpigmented. Prostomium prolobous. Dorsal pores lacking. Nephropores unrecognizable. Setae begin on ii on which all four couples are present; *ab* and *cd* about equal, *aa* and *bc* usually about equal though there is some variation, *dd* ca. = ½C.

The clitellum is reddish to light yellowish, annular, not protuberant, apparently extending from a posterior portion of xiii to 19/20 or onto the anteriormost portion of xx but anterior and posterior limits are unrecognizable externally; intersegmental furrows lacking, setae present. In *aa* the clitellar coloration is often lacking but the epidermis is thickened though not as much as lateral to *b*, clitellar thickening lacking ventrally on xiii and probably also on xvii–xx.

The spermathecal pores are transversely placed slits in *ab*, on 7/8 and 8/9, the centres about at mid *ab*. The margins of the apertures are protuberant (occasionally wrinkled) but are not delimited peripherally to form a lip.

The female pores are minute, transversely placed slits slightly behind the site of 13/14, just lateral to *b*.

On xvii–xix, on each side, and extending median to *a* and lateral to *b* is a longitudinally placed, slightly raised, fairly sharply demarcated, rather dumb-bell-shaped area that reaches to or nearly to 19/20 and nearly to 16/17, a central portion of the nearly circular anterior and posterior end parts especially protuberant. Along each of these areas and reaching nearly to the setal arcs of xvii and xix there is a nearly straight band of greyish (epidermal?) translucence. This band usually has a smooth rather than a grooved appearance (*i.e.*, no trace of seminal groove recognizable) but on the clitellate Rangoon worms the band is less obvious, apparently replaced on some specimens by a slight groove. At the anterior and posterior ends of each band or groove and about on the setal arcs of xvii and xix there is a transversely placed

slit-like aperture which opens into a slight parietal invagination with a transversely slit-like lumen. On most of the specimens each aperture is occupied by a transversely placed, shortly ellipsoidal, transparent to translucent vesicle, the anterior vesicle attached to the posterior wall of the invagination, the posterior vesicle to the anterior wall. These vesicles may be conspicuously protuberant from the body wall on short but narrow necks or fully or partially retracted into the invaginations. After forcing the vesicle back against the wall to which it is attached there becomes visible on the roof of the invagination a minute pore which is probably the prostatic aperture. On the setal arc of xviii and on each longitudinal grey band there is a minute opening, probably the male pore. Median to this aperture and also on the grey band setae *a* and *b* of xviii are usually visible, slightly displaced mesially. Occasionally only one of a pair is visible. Ventral setae of xvii and xix are invisible or unrecognizable externally but within the parietes just median to the ectal ends of the prostatic ducts, after separation of the longitudinal muscle fibres, there may be present setae, so closely paired that they appear to be in the same follicle (attempts at removal unsuccessful).

The genital markings are unpaired, transversely placed areas of epidermal thickening with rounded lateral margins, reaching anteroposteriorly to or almost to the intersegmental furrows, and extending laterally on each side into the median portion of *bc*. The epidermal thickening is much more marked laterally than midventrally but there is no other indication of a double origin such as incisions of anterior and posterior margins at the midventral line. Just lateral to *b* on each marking is a minute aperture. Markings are located as follows: on xxi (29 specimens), on xxi — right side only (1), on xxi — left side only (1), on xx and xxi (4, on two of which the anterior marking is asymmetrical). One clitellate specimen has no marking.

On juvenile and aclitellate Rangoon specimens the dumb-bell-shaped male porophores are lacking but on the larger specimens prostatic pore invaginations and associated vesicles are developed. Genital markings and gland apertures are quite unrecognizable though the glands are present.

Internal anatomy. All septa from 5/6 posteriorly are present; 5/6–8/9 thickened and muscular.

The pharyngeal bulb is small and short. The oesophagus in iv–vi is narrow and with thin, transparent or translucent wall. There are masses of iridescent glands (?) in iv–vi, those in v especially large. The gizzard, in vii, appears to be more muscular than in *saltensis*. Calcif-

erous sacs are like those of *saltensis* except that here the lumen is triangular in section (4 sacs) and the sacs do not reach to 8/9 to which they are connected by strands of tissue. Longitudinal ridges are visible on the inner wall of the sac, the wall so thick and the lumen so small that the walls are almost in contact centrally. The intestine begins in xii, the oesophageal valve distinct and in the anterior part of the segment. No typhlosole.

The dorsal blood vessel is single. The supra-oesophageal trunk extends from a posterior portion of viii into xi where it bifurcates just in front of 11/12, the branches passing laterally onto the anterior face of 11/12 behind the hearts and then ventrally onto the parietes where they can be traced anteriorly into ix. In one specimen, on the left side, a large vessel rises from the parietes onto the anterior face of 10/11 and then passes behind the heart of x to open into the supra-oesophageal trunk. In ix a large vessel from the dorsal face of each calciferous sac joins the supra-oesophageal just anterior to 9/10. Extra-oesophageal trunks are recognizable just ventrolateral to the gut in vi, running posteriorly through vii and viii, in ix passing onto the ventral faces of the oesophageal sacs where they become invisible. The hearts are two pairs, in x–xi, dorsally an anterior branch from each heart opening into a bifurcation of the supra-oesophageal in xi, or into the vessel from the parietes in x, or directly into the supra-oesophageal, a posterior branch opening into the dorsal blood vessel. The commissures of ix may be as large as the hearts of x and xi but only open into the dorsal trunk from which smaller commissures are given off in viii–v. Ventral stumps of the commissures of vii–ix and of the hearts of x–xi join the ventral trunk but the vessels have not been traced completely around the oesophagus. The ventral trunk is unrecognizable anterior to vii. No subneural trunk.

The nephridia from xx posteriorly are large, in contact with both septa of a segment, extending from mid *bc* nearly to the mid-dorsal line. The preseptal funnels are delicate, translucent, small, just median to *a* and close to the ventral parietes, the neck long, very slender and transparent. In xix–xii the nephridia are much smaller and in the anterior portions of the segments just behind the septa (funnels not found). From xi anteriorly nephridia have not been found and if present must be still smaller.

The coelomic cavity of x is filled with a loose, non-iridescent coagulum. The funnels (one pair only) are large, frilled, and characterized by a brilliant pinkish iridescence. The posterior vesicles are large, reaching up into contact with each other above the dorsal blood

vessel, lateromesially flattened, pushing 11/12 back into contact with 12/13 (1) or penetrating 11/12 and dislocating 12/13 posteriorly. The anterior vesicles are large, reaching up into contact with the dorsal trunk and filling all of the available space in ix. Both pairs of vesicles are lobed, those of ix softer and more fragile. The prostates are at least six mm long, reaching back into xxviii–xxx but looped and in part twisted together so that they are long enough to reach several segments further. The ducts are ½–1 mm long, much slenderer than the glands, opaque but with no muscular sheen, passing into the parietes in xvii and xix. The vas deferens passes into the parietes in xviii just lateral to a pair of setae.

The sphermathecal ampulla is shortly ellipsoidal, filled with a non-iridescent whitish or yellowish material. The coelomic portion of the duct is about as long as the ampulla, slightly narrower, rather flattened, with slight constrictions (2–4) that produce a rather irregularly moniliform appearance, bound down to the parietes. The wall is slightly thicker than that of the ampulla, the lumen transversely slit-like to flatly elliptical in cross section. In the parietes the duct is somewhat narrowed and the wall is tougher but the lumen is still transverse. In an ectal portion of the duct of each of several spermathecae there is an elongate, rather pyriform mass of iridescent material, presumably spermatozoa.

Each ovary contains only a few relatively large ova.

The genital marking glands are stalked and cœlomic, tubular. The duct is of about the same length as that of a prostate but is slenderer, translucent, and sinuous. The gland is one to three times as long as the duct, ½–1½ mm long, much slenderer than the prostates and of course shorter. A delicate connective tissue investment is recognizable at the margin of the gland. In sections the epidermis of the genital markings appears to be about half again as thick as in the surrounding region.

The epidermis is also considerably thickened at the anterior and posterior ends of the dumb-bell-shaped male porophores. The prostatic duct passes into the centre of a fairly sharply demarcated area of circular outline in the parietes but this area is not protuberant into the coelomic cavity. In xvii–xix there are numerous diagonal muscle fibres.

Remarks. Although anterior and posterior boundaries of the clitellum are unrecognizable externally in the sectioned body wall at the mid-dorsal incision, the clitellar thickening of the epidermis is clearly visible even on xiii and xx.

Spermathecal apertures of the Kungyangon and a few other speci-

mens are open and occupied by plugs of transparent material that are continued internally for some distances into the coelomic portions of the spermathecal ducts.

A middle portion of the dumb-bell-shaped male porophore may be scarcely recognizable or quite invisible. The longitudinal grey lines may be bent laterally very slightly in the region of the setal arc of xviii or in such a way as to subtend a very wide, obtuse angle.

The transparent vesicle of the prostatic pore invagination appears to be similar to the "clear gland" associated with the ectal end of the prostatic duct of *Aphanascus oryzivorus* Stephenson 1924. Stephenson (1924, p. 362) mentions a possibility that the "clear glands" disappear at full maturity. No evidence for such disappearance is provided by the Burmese specimens of *E. peguana*.

The left calciferous sac of one Moulmein specimen is lacking, the right gland about twice the usual size.

E. peguana, with spermathecal pores in *ab*, has affinities with the following species: *E. halophila* (Beddard), 1892, *E. asuncionis* (Rosa) 1895, *E. kükenthali* (Michaelsen) 1908 and *E. selangorensis* (Stephenson) 1930. From each of these species *peguanus* is distinguished by the presence of "clear glands" in prostatic pore invaginations, presence of genital markings and the prostate-like glands associated with the genital markings.

Diagnosis. Prostatic pores on roofs of transversely slit-like parietal invaginations with transversely placed apertures in *ab* on protuberant anterior and posterior ends of paired, longitudinally placed, dumb-bell-shaped porophores; a transversely ellipsoidal, protrusible clear gland on the posterior wall of each anterior invagination and the anterior wall of each posterior invagination. Male pores on setal arc of xviii just lateral to *b* which is slightly displaced mesially. Genital marking a transversely placed area of epidermal thickening on xxi, reaching anteroposteriorly nearly to intersegmental furrows and laterally into *bc*, a pore just lateral to *b* on each side. Quadrithecal, spermathecal pores in *ab*, with centres about at mid *ab*. Setae: *ab* = *cd*, *aa* = *bc*, *dd* = ½*C*; ventral setae of xvii and xix present (?) but unrecognizable externally. Nephropores? Clitellum annular but thinner and colorless in *aa*; on xiii–xx. Prostomium prolobous. Unpigmented. Length 20–50 mm. Diameter ¾–1 mm.

Gizzard in vii. Seminal vesicles in ix and xi. Spermathecal duct about as long as ampulla and nearly as wide but with slightly thicker wall and transversely slit-like lumen, moniliform and bound to the parietes. Genital marking glands tubular, stalked and coelomic.

Distribution. Known at present only from Burma (Amherst, Hanthawaddy, Myaungmya, Insein and Yamethin districts) but possibly as widely distributed in the tropics as *E. saltensis* and other peregrine Ocnerodrilids.

Eukerria saltensis (Beddard)

1895. *Kerria saltensis* Beddard, Proc. Zool. Soc. London, 1895, p. 225. (Type locality Salto, Valparaiso, Chile. Types in the British Museum.)

Material examined. From Burmese collections:

Pyinmana, Yamethin district, October, 1 clitellate specimen. K. John.

Monywa, Lower Chindwin district, September, 1 clitellate specimen. Saw San Thwe.

External characteristics. Length 27–30 mm. Diameter *ca.* 1 mm. Unpigmented. Prostomium epilobous but with no furrow at posterior margin of tongue. Dorsal pores lacking. Nephropores unrecognizable. Setae begin on ii on which all four couples are present; *ab* and *cd* about equal, *aa* slightly larger than or about equal to *bc*.

The clitellum is light brownish, saddle-shaped (?), not protuberant, reaching ventrally to *b*, extending antero-posteriorly onto xiii and at least to 19/20 but without recognizable anterior and posterior demarcation; intersegmental furrows lacking, setae present. The ventral setae of xiv–xvi appear to be enlarged.

The spermathecal pores are not minute, being definitely larger than other reproductive apertures, shortly elliptical, on 7/8 and 8/9, slightly median to *c*. The margin of each aperture is tumescent as a clearly demarcated, annular lip.

The female pores are on *b*, slightly behind the site of 13/14, the margins slightly tumescent so that the pores appear to be transversely slit-like.

In the male region, on each side, there is a longitudinally placed, slightly raised, rather dumb-bell-shaped area just lateral to *b*, extending anteroposteriorly to just in front of or just behind the setal arcs of xvii and xix. The anterior and posterior portions of each porophore are especially protuberant, a midventral region between the porophores slightly depressed. Along each porophore there is a greyish translucent band on which no seminal groove is visible (possibly grooved on Pyinmana specimen?). Immediately behind the setal arc of xvii (Monywa specimen) there is in the epidermis a transversely placed, slightly crescentic band of greyish translucence, the concave side posteriorly. The minute prostatic pores are at the ends of the longitudinal grey bands of the porophores, the male pores also in the bands, on xviii, on

the setal arc (all pores just lateral to *b*). Ventral setae of xvii–xix are all present but probably are smaller than on neighboring segments.

Internal anatomy. (Monywa specimen). All septa from 5/6 posteriorly are present; 6/7–8/9 thickened and opaque but with no muscular sheen.

The pharyngeal bulb is short. At each side of the gut in iv, v and vi there are masses of glandular (?) material with a brilliant iridescence, those in iv especially large. From the pharyngeal bulb to 6/7 the gut is slender, unconstricted septally and with thin wall. The portion of the gut in vii has a smooth surface, rounded shape, and is fairly strong though not greatly muscularized. In ix the gut is quite slender and fairly high in the coelomic cavity. Attached to each side posteriorly and dorsolaterally is a rather pear-shaped calciferous sac which passes below the level of the gut and then anteriorly to the posterior face of 8/9 to which it is adherent (segment ix unusually long). The aperture into the gut is small and rather star-shaped but the lumen of the sac is horizontally slit-like in transverse section. The intestine begins in xii. No typhlosole.

Hearts of x–xi all open into the supra-oesophageal and dorsal trunks. The commissures of ix are slenderer than the hearts and apparently open only into the dorsal blood vessel. No subneural trunk.

Nephridia are rather small, transversely placed against the parietes, extending from *b* to just lateral to *d*, the neck long and slender, the preseptal funnel close to the ventral parietes near *b*. On each postclitellar nephridium there is a little granular, transparent material. From xvi–x the nephridia are still smaller but were not seen from ix anteriorly.

In the ventral portion of x there is on each side a compact iridescent mass of spermatozoa adherent to the male funnel from which it can be removed only with some care, the funnels with a brilliant iridescence. Testes were not seen. The vas deferens is large in xi–xiii and slightly iridescent throughout so that it can be traced easily in spite of the slenderness of the posterior portion, passing into the parietes in xviii, just lateral to the ventral setae. The seminal vesicles of ix are fairly large, filling all available space in the segment and reaching up into contact with the dorsal trunk. The posterior vesicles are lateromesially flattened, reaching into contact with the dorsal blood vessel, and extending through 11/12 to 12/13 which is pushed into contact with 13/14. Prostates are twisted together but are long enough to extend through several segments. The ducts are much thinner than the glands

and with very slight muscular (?) sheen, passing into the parietes just lateral to the ventral setae of xvii and xix.

Each ovary contains a few, relatively large ova.

The spermathecal ampulla is shortly ovoidal, the narrowed portion ectally. The ampulla is filled with a compact mass of spermatozoa, a slight iridescence visible through the translucent wall. The duct is slightly shorter than the ampulla and slender. There are no diverticula or seminal chambers.

Remarks. The saddle-shaped appearance of the clitellum may be due, as in *peguana,* merely to a lack of clitellar coloration midventrally. Some confusion has resulted from attempts to use clitellar characteristics for specific definition in small species of *Dichogaster* as well as certain Ocnerodrilids. Even in larger forms where clitellar characteristics are determinable with more certainty there may be some variation with respect to extent and apparent shape of the clitellum.

Diagnosis. Prostatic pores minute and superficial, on setal arcs of xvii and xix and at anterior and posterior ends of grey, translucent bands on paired, longitudinally placed, dumb-bell-shaped porophores just lateral to *b*; male pores on setal arc of xviii and on grey bands. Quadrithecal, spermathecal pores slightly median to *c*. Setae: $ab = cd$, $aa\ ca. = bc, dd = \frac{1}{2}C$; ventral setae of xvii–xix present. Nephropores? Clitellum annular (but thinner and colorless ventrally?); on xiii–xx. Prostomium epilobous. Unpigmented. Length 25–30 mm. Diameter 1 mm.

Gizzard in vii. Seminal vesicles in ix and xi. Spermathecal duct slightly shorter and slenderer than the shortly ovoidal ampulla.

Distribution. Probably widely distributed throughout tropical and possibly subtropical regions but recorded hitherto only from Chile, South Africa, Australia, New Caledonia and Burma (central region, Yamethin and Lower Chindwin districts).

Genus Gordiodrilus Beddard 1892

This genus provides one of the most difficult problems in Megadrilid taxonomy. In his 1930 monograph Stephenson characterized *Gordiodrilus* as follows: "Condition of male apparatus very various — incompletely or irregularly microscolecine, or showing a tendency to balantine reduction or megascolecine. Two or one or no gizzards. A single oesophageal sac, or a pair, in ix. Holandric, metandric, or proandric. Spermathecæ without diverticula on the duct, but sometimes with evaginations at the ectal end of the ampulla." (The Oligochaeta,

1930, p. 863). Obviously this is merely a statement of variation in a group of species without morphological or geographical unity and as a "diagnosis is so indefinite as to be meaningless", as is admitted by Stephenson who adds, "I can do nothing with this heterogeneous group of species, extending over nearly the whole African continent" (l.c. p. 863).

Casual comparison of the definition above with those of other Ocnerodrilid genera in the same work, suggests that the Gordiodrilid chaos resulted, in part at least, from neglect to continue to use those characteristics which were employed, with apparent success, in definition of other genera in the family (in particular characteristics of the digestive system relating to gizzards and calciferous sacs).

A genotype, so far as can be discovered from the literature available, has never been designated. One candidate for the honor is *G. tenuis* Beddard 1892 although this form is probably a ghost species, unembodied in a material type. (The single type was sectioned but whether sections of this as well as of other holotypes have been preserved and are now of use is unknown.) Some characteristics of specific, possibly even of generic importance are unknown but the species does lack a gizzard, does have a single, ventral calciferous sac in ix and four prostates, a combination of characteristics at present capable of distinguishing a genus from all other Ocnerodrilids as well as from certain groups of species now included in *Gordiodrilus*. *G. tenuis* is supposedly metandric but mention is made of seminal vesicles in x–xiii. Vesicles are hardly to be expected in xi of a metandric species, and it is quite possible that testis sacs of the *Ocnerodrilus* type, in x and xi (or even masses of coagulum) were mistaken for seminal vesicles. An anterior pair of male funnels may have been lost (as in some sections just examined) or unrecognized. Furthermore it should be noted that metandry may appear in a group of related species without necessity or even possibility of generic or subgeneric division (as in *Eutyphoeus*, and *vide* also subsequent remarks on *Malabaria*). Location of prostates in xx and xxi rather than in xvii and xix as in the supposed ancestral form is evidence for a derived or specialized rather than a primitive status and if *tenuis* is actually metandric, less specialized species in a *tenuis* group might well be holandric. In spite of the posterior location of the male terminalia an approximation to an acanthodriline condition is maintained, as the male pores apparently are midway between the prostatic pores. A *tenuis* group, as will be seen below, can be defined in terms of maintenance of this approximation to an acanthodriline condition but not with respect to a normally acanthodriline segmental

location, a development somewhat similar to that in the North American Megascolecid genus *Diplocardia*, where the male pores may be on xviii, xix, xx or xxi, with corresponding shifts in the four prostates.

A generic definition for a *tenuis* group of species may then be worded somewhat as follows. Quadriprostatic, prostatic pores at termini of seminal grooves, the male pores also in the grooves and intermediate[1] between the prostatic pores (or between the first and last pairs when three pairs are present). Setae closely paired. Clitellum annular.[2] No gizzard, calciferous sac ventromedian in ix. Holandric; seminal vesicles in (ix?) xii.[3]

No mention is made in this definition of the intestinal origin in xii, absence of a typhlosole, restriction of latero-oesophageal hearts to x-xi, or the paired presetal female pores on or close to *b* lines of xiv, as there is evidence to indicate that these characteristics are found in a considerable portion if not a very large majority of the Ocnerodrilidae. Presence of small chambers in or on the ducts of the spermathecae may characterize a definite group of species or even a greater proportion of the genus than is now recognized. "Evaginations" of spermathecal ampullae may be only accidental constrictions.

In a generic group as defined above there would be included: *tenuis* Beddard 1892, *elegans* Beddard 1892, *zanzibaricus* Beddard 1894, *madagascariensis* Michaelsen 1907, *travancorensis* Michaelsen 1910, *habessinus* Michaelsen 1913, *paski* Stephenson 1928, *unicus* Stephenson 1931, *wemanus* Michaelsen 1937, *pegnanus* sp. nov., and possibly also the following,—*ditheca* Beddard 1892, *dominicensis* Beddard 1892, *papillatus* Beddard 1901, *mobucanus* Cognetti 1907 and *chuni* Michaelsen 1913.

In accordance with orthodox theory as to Oligochaete evolution, the most primitive species of the restricted *Gordiodrilus* is *unicus* with normally acanthodriline male terminalia. This form is known only from Bhamo in northern Burma but a short distance from the Chinese frontier. It is improbable that this is the original home of the species. A longitudinal area in east Africa apparently characterized by group 2 crosses a transverse area possibly characterized by group 3 in the region of Mt. Ruwenzori where the original home of *unicus* may perhaps be anticipated. Only one specimen of *unicus* is known and this has a

[1] Supposed union of male and prostatic pores on xviii in *travancorensis* needs confirmation.

[2] The clitellum is said to be saddle-shaped in both *tenuis* and *elegans* but a figure of each species apparently shows clitellar development ventrally.

[3] Vesicles, recorded on several occasions from x and xi, may again be only testis sacs of the *Ocnerodrilus* type, at height of sexual development. Seminal vesicles would then be unnecessary and perhaps first lost in ix as apparently in some other genera of the family.

single prostate in xviii, presence of which may be an abnormality. However prostates are present in xviii in certain Ocnerodrilids with a frequency to indicate a possibility at least that the ancestral condition was sexprostatic rather than quadriprostatic as hitherto assumed.

A group of species (2, *unicus* and any related species being 1) including *zanzibaricus* (Zanzibar), *habessinus* (Abyssinia), *paski* (Tanganyika), *wemanus* (Kenya), *peguanus* (Burma) and possibly also *dominicensis* (Dominica but via Kew) and *chuni* (Rhodesia), has prostates in xvii and xviii and male pores on or near to 17/18. This condition may be derived from the sexprostatic merely by elimination of the prostates of xix and dislocation anteriorly of the male pores to points midway between the remaining prostatic apertures. The male pores of *zanzibaricus* according to Beddard are "precisely" as in *elegans* but pores on *elegans* are at 18/19 while seminal grooves of *zanzibaricus* are on xvii and xviii. Assuming that Beddard was correct with regard to the location of the seminal grooves, it is unlikely that the pores are on 18/19, although Beddard confirmed the location of the pores of *elegans* in 1901 (p. 364). Information available from distribution indicates that the statement as to segmental location of the seminal grooves of *zanzibaricus* is to be accepted rather than that as to location of the pores.

The type of *chuni* is abnormal and the absence of a second pair of spermathecae may also be an abnormality. In the description of *dominicensis* prostatic pores are at first said to be on xviii and xix with ventral setae of xviii and xix lacking) while on p. 95 the pores are said to be on xvii and xviii, a location which was confirmed by Beddard in 1901 (p. 364). The athecal condition may be an abnormality as in Burmese species of *Malabaria*. At present the original home of this group would appear to be somewhere in eastern Africa between Rhodesia and Abyssinia.

A third group of species, including *travancorensis* (South India), *madagascariensis* (Madasgacar), *elegans* (supposedly from Lagos but actually found at Kew) and possibly also *mobucanus* (Mt. Ruwenzori), has prostates in xviii and xix and male pores on or near to 18/19. This condition may be derived from the sexprostatic by suppression of the prostates of xvii and the dislocation posteriorly of the male pores. *G. mobucanus* is said to be bithecal but the species is so inadequately characterized as to be unrecognizable. Available information is sufficient to indicate nothing more than a possibility that group 3 is endemic in a more western portion of Africa than group 2, possibly from Mt. Ruwenzori to Lagos (Indian and possibly Madagascar record of peregrine forms).

G. papillatus (from Lagos) with no gizzards and a single calciferous sac is mentioned here because of a remote possibility that it provides a transition between groups 3 and 4. A part of the difficulty in placing the species is due to another of Beddard's contradictions. On p. 360 the prostatic pores are said to be at the termini of the seminal grooves on xviii and xix which would indicate inclusion in section 3, but on p. 362 the prostatic pores are said to be on xix and xx with the male pores in the region of 19/20. The species is however characterized by the presence in the male terminalia of large muscular bulbs similar to those of *Nannodrilus*. Inclusion in *Nannodrilus* would require an assumption that gizzards in vii and viii and prostates opening into the copulatory chambers had been overlooked. The seminal grooves present here are lacking in *Nannodrilus*. A possibility of independent development of copulatory chambers in non-Nannodrilid forms may have to be considered. Copulatory chambers, though of a much smaller sort, are now known from one species of *Enkerria* and coelomic copulatory chambers apparently have evolved in different groups of the Megascolecid genus *Pheretima*.

The fourth section contains only one species, *tenuis* (supposedly from Assaba, West Africa, but actually from Kew). In this species the prostatic pores are on xx and xxi with the male pores on or near to 20/21. The finding of this species towards the western margin of a group 3 area, together with a possible Lagos origin of *papillatus*, is of interest though perhaps of no particular significance.

In *Diplocardia* with developments somewhat similar to those characteristic of *tenuis* the word usually used is "shift", as if the prostates originally present in xvii and xix had been translocated posteriorly, perhaps as a result of a long series of very slight backward shifts or of a lesser number of more marked mutations. The occasional presence of prostate-like glands in the Ocnerodrilidae behind the usual series of two or three pairs, suggests an alternative, *ie.*, the appearance of one or more pairs of supernumerary structures throwing the primitive relationship out of balance with a consequent posterior dislocation of the male pores to restore the balance. Loss of one or more prostates at the anterior end of the series would again upset the balance and be followed by still further posterior dislocation of the male pores. In this connection it may be noted that a number of interesting problems in earthworms in connection with conditions apparently suggestive of induction, attraction or organ balance effects await investigation.

G. dithecа (Lagos via Kew) cannot be placed in any group. Male pores are supposedly on xviii and there is a single pair of prostates but

the location of the prostatic pores is unknown. Supposedly bithecal the location of spermathecal apertures is also unknown. The bithecal condition may be an abnormality as well as the absence of a second pair of prostates.

Nannodrilus Beddard 1894 was united with *Gordiodrilus* in 1913 by Michaelsen, who had come to believe that the male genital terminalia in *Kerria* (now *Eukerria*), *Gordiodrilus* and *Nannodrilus* formed a series that should not be interrupted, while gizzards and copulatory chambers were regarded as not providing characteristics of generic value in this particular connection. *Kerria* however was not united with *Gordiodrilus* and the reasons advanced do not appear to be of much importance. Like *Gordiodrilus*, *Nannodrilus* has only a single ventral calciferous sac in ix but this in itself is no more justification for union of the two genera than the presence of a single pair of sacs in ix is for a union of *Eukerria*, *Kerriona*, *Haplodrilus* and *Nematogenia*. A Nannodrilid group of species can be defined generically as follows: Male pores on xviii. Bithecal, spermathecal pores on 7/8. Clitellum annular. No seminal grooves. Gizzards in vii and viii. Calciferous sac ventromedian in ix. Holandric, seminal vesicles in ix and xii. Vasa deferentia of a side after union open into a thickwalled and muscular "copulatory chamber" into which one pair of prostates also opens. Spermathecae adiverticulate. This definition certainly appears to be as good as any now available in the Octnerodrilid family.

To be included in *Nannodrilus* are: *africanus* Beddard 1894 (Lagos), *staudei* Michaelsen 1897 (Egypt), *phreoryctes* Michaelsen 1903 (Cameroons), *schubotzi* Michaelsen 1915 (French Congo) and possibly *togoensis* Michaelsen 1913 (Togo), as well as another form hitherto unrecognized as specifically distinct. The distribution may indicate an endemic area in Dahomey to French Congo, the Egyptian record a result of transportation.

Here again it seems possible to start with a sexprostatic condition and differing from the primitive Gordiodrilid condition only in the presence of a pair of copulatory chambers into which both pairs of male deferent ducts and the prostates of xviii open. From such a primitive stage, *schubotzi* (in part only) differs merely in the location of the anterior prostatic pores on or near to 17/18 rather than midsegmentally on xvii and the location of the posterior prostatic pores also in front of the setal arc. Some of the types of *schubotzi* have a second pair of prostates opening into the copulatory chambers but with no external prostatic apertures anteriorly. Michaelsen apparently assumed that the anterior prostates had become disengaged from their parietal

attachment in the region of 17/18 and reattached to the copulatory chambers. That such a development can occur as an intraspecific variation seems rather doubtful and the specimens with two prostates on each chamber should perhaps be regarded as specifically distinct. In *staudei* the anterior prostates are on a presetal portion of xviii and perhaps furnish in this respect a condition intermediate between *schubotzi* and the species of the excluded specimens. In *N. africanus*[1] the posterior prostates have been lost but the anterior prostates are retained in the original position on xvii. In *phreoryctes* both anterior and posterior prostates have been lost. It will be interesting to learn if some undescribed species has retained the posterior prostates after loss of the anterior glands.

G. togoensis can be included in *Nannodrilus* if gizzards in vii and viii were overlooked and would then differ from the excluded types of *schubotzi* in the absence of prostates with external apertures. If however gizzards were actually lacking in *togoensis* recognition of another genus must be considered. This would be distinguished from *Gordiodrilus* by the absence of seminal grooves and of prostates with external apertures, and from *Nannodrilus* by absence of gizzards and of prostates with external apertures.

Relationships of the quadrithecal (cf. footnote on *africanus*) *johnsoni* Michaelsen 1936 (Belgian Congo) are even more uncertain, primarily because of doubt as to the calciferous glands which are said to be not wholly unpaired, but with two rounded "Kuppen", accurate characterization impossible because of gaps in serial sections. If an unpaired Nannodrilid sac is present and gizzards were overlooked, inclusion in *Nannodrilus* is possible and the predicted stage without anterior prostates is available. If gizzards are actually lacking as well as in *togoensis*, then both of those species might belong to a genus paralleling *Nannodrilus* in the evolution of the male terminalia.

G. robustus Beddard 1892, with a gizzard in viii and possibly a rudimentary gizzard in vii, in accordance with procedure followed hitherto must be excluded from *Gordiodrilus*. The presence of seminal grooves and absence of copulatory chambers seem to make consideration of relationships with *Nannodrilus* unnecessary. Again a new generic group seems to be indicated. The calciferous gland of *robustus* is at first said to be single and ventral but whether this was determined

[1] Again we have to do with contradictory statements in Beddard's descriptions. In the definition of *africanus* the species is said to be quadrithecal but on p. 390 only one pair of spermathecae is mentioned and that in vii, the location of the pores not given! Further, in the definition of *Nannodrilus* the anterior pair of prostates is said to open in common with the deferent ducts, but fig. 3 contradicts this.

from the dissection or from sections is not clear. In a footnote on p. 83 Beddard says that a specimen dissected after completion of the account above has paired calciferous sacs! The material studied by Baldasseroni and Michaelsen apparently indicates that the unpaired condition should be accepted as correct, in which case the specimen with paired calciferous sacs must be referable to a distinct genus (vide *Diaphorodrilus*). All of the forms to be considered with *robustus* are characterized by presence of genital markings. Nothing is known as to parietal modification or glands associated with those markings but such glands might also provide characteristics of generic value. A high, lamellar type of typhlosole has been recorded from one of the forms. In view of the apparent rarity of that structure in the Ocnerodrilidæ this might well be a characteristic of generic importance. A *robustus* group of species could then be defined generically as follows: prostatic pores at termini of seminal grooves which also include male pores, midway between the prostatic pores. Genital markings present behind the male genital region. Setæ paired. Clitellum saddle-shaped. Gizzard in (vii? or?) viii; calciferous sac ventromedian in ix; high lamellar typhlosole present from xvii (to ?). Holandric, seminal vesicles in xi and xii. Spermathecae adiverticulate and with unusually long ducts. Genital marking glands? Included in addition to *robustus* (supposedly from Lagos but actually from Kew) are: *pampaninii* Baldasseroni 1913 (Tripolitania) and *congicus* Michaelsen 1936 (Belgian Congo). The area of endemicity appears to be Central Africa while intervention of the Sahara dessert suggests transport of one species to Tripolitania. A sexprostatic form is unknown but presence of prostates in xviii of all species once more suggests a possibility of a sexprostatic ancestral or primitive type. Male pores have not been identified definitely in any of the forms but are thought to be in the region of 18/19 in *pampaninii* with posterior prostates. By analogy with *Gordiodrilus*, forms with anterior prostates should have male apertures on or near 17/18 (also indicated by Beddard's fig. 5) and evolution of similar intra-generic groups may be expected.

Along with *Nannodrilus*, Michaelsen united *Diaphorodrilus* Cognetti 1910 with *Gordiodrilus* as presence of three pairs of prostates and a location of the male pores of 16/17 are inadequate for generic distinction, and further that the third pair of spermathecae is of no significance being merely in correlation with the three pairs of prostates with external apertures. The validity of the criticism as to the taxonomic value of the three pairs of prostates and spermathecae may be accepted, at least for the time being, but it is doubtful if equality in

number of spermathecal and prostatic pores is of any particular significance. Correlations between number of spermathecal pores and male pores (Stephenson) or prostatic pores (Michaelsen) have been assumed, but a hasty survey of various families of earthworms indicates that any equality in number of spermathecal pores with either male or prostatic apertures is only casual.

Diaphorodrilus does however have a pair of lateral calciferous sacs in ix which seems to provide much more of an argument for union with *Eukerria* than any other characteristic provides for union with *Gordiodrilus*. The distribution of *Eukerria* (restricted to southern South America, except for *zonalis* and *mcdonaldi* which are known only from Lower California and should be under suspicion of transportation, though usually regarded as endemics) presumably was the reason for Michaelsen's failure to follow his own suggestion (in spite of the presence of endemics of the subgenus *Illyogenia* in both Africa and America). Leaving aside for the present discussion of possible relationships with other genera having paired sacs in ix only, which would require consideration of all of the remaining African Ocnerodrilids, recognition of *Diaphorodrilus* as generically distinct from other Gordiodrilids is necessary. By analogy with *Gordiodrilus* and *Nannodrilus* the sexprostatic genotype should be primitive. Unfortunately the segmental locations of the terminalia are uncertain because of another of the contradictions that characterize so much of the work on Gordiodrilids. According to one statement and one figure the prostates are in xvi, xvii and xviii while according to another statement and figure the last pair of prostates is in xix. The male pores were unrecognizable but Cognetti thought they were on 16/17, certainly a most unusual location either from the standpoint of location in the Megascolecidae (in which the Ocnerodrilidae are usually included) or from that of interorgan balance. Quite possibly the confusion as to location of the prostates was due to some sort of segmental abnormality in the region of the male terminalia with an apparent dislocation of male apertures. In that case the normal condition might well be that of the usual primitive form with male pores and apertures of a middle pair of prostates on xviii. If otherwise, *doriae* (Fernando Po) might have been derived from the primitive type by a mutational addition of an extra pair of prostates at the anterior end of the series rather than at the posterior end as in *Gordiodrilus*, followed by suppression of the prostates of xix and anterior dislocation of the male pores. All of the species of *Gordiodrilus* not hitherto mentioned agree with *Diaphorodrilus* in the possession of paired calciferous sacs in ix, adiverticulate spermathecae,

a constant segmental location of spermathecal pores (rather than intersegmental),[1] holandry (seminal vesicles in xi–xii?). Otherwise this group of species at present does not appear to have much in common although here as elsewhere information is lacking with regard to a number of characteristics that may be of taxonomic value. In *luykerleni* Michaelsen 1913 (Rhodesia) the male pores are on xviii, either united superficially with or immediately lateral to the prostatic pores, the anterior prostates suppressed. In *overlaeti* Michaelsen 1936 (Belgian Congo) the male pores are united with the prostatic pores of xix, prostates of xvii and xviii eliminated but prostate-like glands in xx are associated with genital markings somewhat as in *E. peguana*. In *thomseni* Michaelsen 1933 (Southwest Africa) the male pores apparently are united with the prostatic pores of xviii while prostates associated with genital markings or porophores may or may not be present on xix. If the group is a natural one developments would appear to be along lines of loss of acanthodriline relationships and of seminal grooves and the evolution of megascolecine and balantine terminalia or approximations thereto.

The suggestions advanced above may be expected to stimulate a natural but superficial criticism of unnecessary generic multiplication. It should however be noted that Africa is the region in which the Ocnerodrilid family "took its rise" (Stephenson 1930, p. 853) and presumably greatest development. Yet only four genera are now recognized from the whole of the African continent. Furthermore the generic distinctions that have been suggested above are on the whole and even in spite of the fragmentary nature of our knowledge of the Gordiodrilid groups, as good as, if not better than those in some other portions of the family. Thus for instance *Kerriona* is distinguished from *Eukerria*, aside from the larger size and pigmentation, only by a wider pairing of the setae in a portion of the axis, all of which are characteristics at times of specific value only or none at all. *Haplodrilus* is distinguished from *Ocnerodrilus* only by its proandry or from *Eukerria* merely by its microscolecine male terminalia. *Pygmaeodrilus* is distinguished from the African section of the subgenus *Ilyogenia* only by diverticulation of the spermathecae (a characteristic apparently not of generic value even in a restricted *Gordiodrilus*) and the approximation (rather than actual union) of male and prostatic pores, a distinction not considered of generic value in *Malabaria* or certain non-Ocnerodrilid genera. Admittedly some of the characteristics sug-

[1] In the Megascolecid *Hoplochaetella* the spermathecal pores are almost universally released from an intersegmental location.

gested for generic definition are not of the usual sort but the taxonomist must be concerned first of all with the actual morphology of his animals rather than the vague ghosts of idealized forms born from phylogenetic speculations.

Of the Ocernodrilid fauna of the African continent certainly but a very small fraction is now known, and almost as soon as new material becomes available for study new genera will be necessary. The information available even now indicates that evolution within the family has not been limited to the very restricted series of developments that have been considered hitherto in Megadrilid phylogeny. Whether or not any of the new genera necessitated by more extensive collecting will be definable as suggested above of course remains to be seen. In view of the difficulties associated with the small size of animals one to two mm. in diameter, inability to reexamine old material, lack of newer material from critical localities, the inadequacy and contradictory nature of so much of the information that is available, and the limited series that have been studied in the past,[1] a satisfactory revision of *Gordiodrilus* is impossible at present. Accordingly nothing that has been said above should be taken as a designation of a genotype for *Gordiodrilus* or as in any way restricting the genus. Until such time as revision becomes practicable, the various groups may be referred to as Nannodrilid, Diaphodrilid or by species names, as "a *robustus* group."

Gordiodrilus peguanus sp. nov.

Material examined. From Burmese collections:

Moulmein, Amherst district, October, 3 aclitellate and 42 partially clitellate specimens. K. John.

Mupun, Amherst district, October, 6 partially clitellate specimens. K. John.

Boyagyi, Thaton district, October, 31 partially clitellate or clitellate specimens. K. John.

Taungzun, Thaton district, August, 1 clitellate specimen. K. John.

Kyaikto, Thaton district, August, 1 clitellate specimen; September, 3 clitellate specimens. K. John.

Sittang, Thaton district, October, 1 juvenile, 53 partially clitellate and 2 clitellate specimens. K. John.

Kyauktan, Hanthawaddy district, September, 7 clitellate specimens. K. John.

Syriam, Hanthawaddy district, September, 1 clitellate specimen. K. John.

[1] Twenty eight species known only from types or original descriptions, seven known only from unique types, seven known only from short series of two (3 species), three (3) or four (1) specimens. Much, if not all of the material available has doubtless been of a disappointingly refractory nature for investigation by means of sections.

Kungyangon, Hanthawaddy district, September, 11 clitellate specimens. K. John.

Rangoon, Hanthawaddy district, June, 33 clitellate specimens; February, 21 clitellate specimens; March, 18 clitellate specimens. K. John.

Hmawbi, Insein district, September, 1 clitellate specimen. K. John.

Minbu, Minbu district, September, 5 clitellate specimens. K. John.

Indaw Lake, Katha district, September, 1 clitellate specimen. Saw San Thwe.

From Indian collections:

Bangalore, South India, 3 aclitellate and 23 clitellate specimens. Prof. C. R. N. Rao.

External characteristics. Length 35–47 mm. Diameter 1–1½ mm. Unpigmented. The prostomium is epilobous, tongue short (30). No dorsal pores. Nephropores? The setae begin on ii on which all four couples are present; behind the clitellum *ab* and *cd* about equal, *aa* slightly smaller than *bc*, *dd ca.*=½C.

The clitellum is dark red, reddish brown, dark yellow, bright yellow or (partially clitellate specimens) light yellow or light brown, annular except on xvii–xviii, not protuberant, extending from a portion of xiii — usually only postsetal — to 18/19 or slightly onto xix, 19/20 or even onto xx (Bangalore worms), the anterior and posterior boundaries indistinct externally but clearly visible at mid-dorsal incisions; intersegmental furrows lacking, setae present.

The spermathecal pores are on 7/8 and 8/9, usually with centers on or close to *b*, a very narrow marginal area immediately in front of and behind the aperture often slightly tumescent so that the aperture at first appears to be large and transversely slit-like. Rarely a single pore may be in the median half of *bc*. Female pores are on or just lateral to *b*, only slightly nearer to the setal arc of xiv than of xiii, hence close to site of 13/14.

On xvii and xviii of a fairly large proportion of the specimens there is a white, transversely placed, slightly raised, almost square male shield, extending anteroposteriorly to or almost to the sites of 16/17 and 18/19 and laterally into the median portion of *bc*, usually fairly level, the boundaries of the shield indicated only by elevation and epidermal whitening. The surface of shield is not as smooth as the epidermis of the surrounding area. The seminal grooves are practically straight, though margins of the grooves are slightly irregular, and extend anteroposteriorly between the setal arcs of xvii and xviii, in the region of *ab*. At the anterior and posterior ends of the grooves the margins may be very slightly swollen. Ventral setae of xvii and xviii

may be lacking (invisible only?) or present in part and displaced mesially; *a* (presumably) of xvii present on both sides (6), *a* and *b* of xvii present on both sides (1), *a* (presumably) of xvii and xviii present on both sides (30). Prostatic and male pores have not been identified definitely but are probably represented by minute, greyish translucent spots at the termini of the grooves (prostatic pores) and midway between the termini (male pores).

On most of the other specimens the unpaired male field is replaced by a pair of longitudinally dumb-bell-shaped, whitened, areas with sharply delimited margins, the wider rounded ends of the porophores much more protuberant than the middle portions. A midventral region between the two areas is usually slightly depressed longitudinally and in addition there may be slight transverse depressions just anterior and just posterior to the areas. The midventral region between the porophores may or may not be colored like the clitellum. On the few remaining specimens the condition of the male field appears to be intermediate between the extremes just described.

Genital markings are lacking. On one worm seta *b* of xvi, on each side, is in a tiny, whitened, transversely placed tumescence.

Internal anatomy. All septa from 5/6 posteriorly are present; 5/6 is membranous and delicate, 6/7–9/10 slightly stronger but almost transparent.

There is no gizzard but the oesophagus in v may be slightly widened in such a way as to look somewhat like a very rudimentary gizzard. Anterior to 5/6 on each side there is a large mass of glandular(?) tissue, characterized in part at least by a brilliant iridescence, the masses covering over the gut dorsally. Similar but smaller glands are present in vi–viii on the anterior faces of the septa just lateral to the gut and median to commissures and nephridia, the size decreasing posteriorly. On the posterior face of 8/9, just lateral to the gut on each side, there is a tiny disc also characterized by a brilliant iridescence. The calciferous sac is large, rather squarish, dislocating 9/10 posteriorly, opening into the gut through a transversely or longitudinally slit-like aperture in the floor of the oesophagus posteriorly in ix, the lumen of the sac small, transversely elliptical to triangular in cross section, nearer the ventral surface of the sac in the anterior portion. On the inner wall of the oesophagus in v–viii there are low, longitudinal, somewhat irregular whitish ridges. Midsegmentally or posteriorly in ix the oesophagus is abruptly widened and remains wide through x and xi. The intestine begins in xii (30), the oesophageal valve small and anteriorly in xii. No typhlosole (4).

The dorsal blood vessel (single) is continued anteriorly to the region of the cerebral ganglia. A supra-oesophageal vessel is visible on the gut in the posterior portion of ix where it receives on each side six to eight parallel vessels from the lateral wall of the oesophagus. Posterior to 9/10 the vessel is usually unrecognizable, but in several specimens a partly empty continuation can be traced to a posterior portion of xi where it bifurcates, the branches passing ventrally on the lateral faces of the gut. Extra-oesophageal trunks are recognizable in v–viii just ventrolateral to the gut, in ix passing onto the ventral face of the calciferous sac where they disappear. No subneural. The hearts of x and xi bifurcate dorsally, one branch passing to the supra-oesophageal or its site (in x) or into the bifurcation of the supra-oesophageal trunk (in xi), the other branch into the dorsal trunk. The last pair of hearts is in xi (30). The commissures of ix are usually as large as the hearts of x but open only into the dorsal blood vessel.

Nephridia from xix posteriorly are large, usually flattened out against the parietes and in contact with both septa of a segment, extending from *a* nearly to the mid-dorsal line. The preseptal funnels are close to the parietes in *ab*. The slender ducts pass into the body wall at or median to *c*, in a presetal portion of the segment. Occasionally median portions of nephridia lack the yellowish, granular investment and are recognizable as tubular loops. Nephridia of xiii–xviii are transversely placed loops, each nephridium with very little or almost none of the granular material. From xii to vi nephridia are located on the anterior faces of the septa and are without investment. Anterior to vi nephridia have not been found.

The male funnels are free in x and xi, usually with a brilliant spermatozoal iridescence. The testes are vertically placed, anteroposteriorly flattened flaps which reach upwards to the level of the gut or rarely even to the dorsal parietes, attached to the posterior faces of 9/10 and 10/11 close to the ventral parietes. The dorsal ends of the largest testes are pointed as a result of an accordion-like folding of a thinner dorsal portion of the organs. When unfolded tiny patches of iridescence, separated by translucent — almost transparent areas, are visible. Deferent ducts are usually recognizable only in xvii or in xvi and xvii, in the latter segment just lateral to the ectal end of the prostatic ducts, passing into the parietes midway between the prostatic ducts of a side. There is a pair of seminal vesicles in xii (30). A structure that appears to be a seminal vesicle was found in ix on the right side of one specimen, paired seminal vesicles present in ix in three Bangalore specimens. Prostates are three to four mm. long, the ducts

about one mm. long, slenderer than the glands and with a very slight (muscular?) sheen, passing into the parietes in xvii and xviii (15), the posterior duct nearer to 18/19 than to 17/18.

The spermathecal duct is longer than the ampulla from which it is sharply demarcated, not especially narrowed in the parietes, the wall thick and the lumen narrow. A middle portion usually somewhat nearer to the ampulla than to the ectal end is slightly thickened so that the duct has a rather spindle-shaped appearance. In the thickened region there are two or more small chambers; one on each side, two on one and one on the other, several on each side, etc., or rarely a complete circle around the duct. Chambers are always empty. No spermatozoal iridescence has been noted in any of the spermathecae but in absence of evidence to the contrary the chambers may be called seminal. Ampullae may contain opaque, white or red material.

Abnormalities. One specimen from Thaton has its left seminal groove on xviii and xix, its left ovary in xiv, left hearts, testes and male funnels in xi and xii, left spermathecae in ix and x. The oesophagus in x has a thick wall like that of the calciferous gland, especially ventrally.

Another worm lacks the right prostate of xvii, the left prostatic duct of xviii bifurcating near the ental end, one branch passing to a normal prostate, the other branch to a short and somewhat irregular gland.

One Bangalore worm has a well developed clitellum on xvii and xviii only. The portion anterior to xvii is probably an abnormal regenerate, with more than 16 segments and no calciferous gland.

Remarks. The unusual size of the structures referred to as testes and the presence in the dorsal ends of those structures of flecks of iridescence apparently indicates presence in this species of testis sacs similar to those of *Ocnerodrilus occidentalis*.

Oviducts of Bangalore worms may contain ova in a swollen ental portion, seven ova present in one duct, three in another.

G. peguanus is distinguished from the Burmese *unicus* by the absence of prostates in xix and restriction of seminal grooves to xvii and xviii; from the Indian *travancorensis* by the presence of prostates in xvii, the discrete and anteriorly located male pores, and the absence of prostates of xix; apparently close to *paski*, from which it is distinguished by the setal ratios ($aa<bc$ rather than $aa>bc$), slightly greater extent of the clitellum (onto xix or xx), epilobous prostomium, presence of testis sacs, and presence of nephridia anterior to xii. Just how many of these distinctions are actual or taxonomically valid remains to be determined.

Diagnosis. Quadriprostatic, pores at termini of straight seminal grooves in *ab*, between the setal arcs of xvii and xviii. Male pores in seminal grooves, midway between prostatic pores and about at site of 17/18. Seminal grooves on paired, longitudinally dumb-bell-shaped porophores or on a transversely placed, slightly elevated shield reaching to or nearly to 16/17 and 18/19 and laterally into the median portion of *bc*. Setae: $ab=cd$, $aa<bc$, $dd=\frac{1}{2}C$; *a* setae of xvii–xviii usually present. Quadrithecal, spermathecal pores on 7/8–8/9, on *b*. Clitellum annular, on xiii–xix or xx. Nephropores? Prostomium epilobous. Unpigmented. Length 35–47 mm. Diameter 1–1½ mm.

Holandric, seminal vesicles in xii. Spermathecal duct slightly spindle-shaped, longer than the ampulla, with two or more seminal chambers in wall of a thickened middle portion.

Distribution. Amherst, Thaton, Hanthawaddy, Insein, Minbu and Katha districts, Burma. Mysore State, India.

Genus Malabaria Stephenson

1924. *Malabaria* + *Aphanascus* Stephenson, Rec. Ind. Mus. XXVI, pp. 356 and 360. (Genotypes *M. paludicola* and *A. oryzivorus* Stephenson 1924.)

1930. *Malabaria* + *Aphanascus*, Stephenson, The Oligochaeta, pp. 857 and 858.)

1938. *Filodrilus* Chen, Cont. Biol. Lab. Sci. Soc. China, (Zool.), XII, p. 422. (Genotype *F. leris* Chen 1938.)

Diagnosis. Male pores on xvii. Biprostatic, prostatic ducts unite with male deferent ducts or open close to male pores. Bithecal, spermathecal pores on 8/9. Setae closely paired. Gizzard in vii. Calciferous diverticula small, paired, in thickened floor of gut in ix and x.

Distribution. India (Malabar, 2 species; Travancore, 1 species; possibly one species in Mysore), Burma (1 species) and China (1 species).

Remarks. Aphanascus is known only from the original account of *oryzivorus* and was distinguished from *Malabaria* by the absence of "prostates" opening to the exterior on xx and by the metandric condition of the male organs. The "prostates" in the genotype of *Malabaria* are associated with genital markings rather than seminal grooves and presumably provide no more justification for generic distinction than do similar glands and genital markings in *Eukerria peguana*. Confirmation of this viewpoint is provided by Aiyer's species, *M.*

biprostata, which has only two prostates. Although regarded hitherto as of generic significance in the Ocnerodrilidae (except in *Gordiodrilus*) metandry usually is not recognized, in itself, as of sufficient importance to warrant generic distinction. In absence therefore of other criteria of generic status, retention of *Aphanascus*, merely because of the metandry, seems unnecessary.

Filodrilus, according to Chen, differs from *Malabaria* in the absence of a posterior pair of "prostates", lack of union of deferent and prostatic ducts, and presence of an additional pair of testes in ix. Absence of posterior "prostates" and of terminal junction of male deferent and prostatic ducts characterize *M. biprostata* and do not appear to be of generic significance. (In *Microscolex*, to mention only one example, male and anterior prostatic pores may or may not be united.) Supernumerary testes, possibly nonfunctional, even when associated with extra male funnels, scarcely warrant generic distinction any more than in *Pheretima anomala* and *Lamprodrilus satyriscus* Michaelsen 1903. Oesophageal diverticula of *Filodrilus* are so described[1] that it is impossible to determine whether or not these structures are the same as in Indian species but there is no evidence available to indicate that the calciferous region is significantly different from that of *Malabaria*. Unless *Filodrilus* can be distinguished by important characteristics of the calciferous region of the gut there seems to be no justification for its retention.

The distribution of *Malabaria* is of particular interest in connection with the phylogeny of the Ocnerodrilidae. Evolution of the first earthworms, the differentiation of the several families and the evolution of the numerous genera is restricted by Stephenson to the Tertiary and Quaternary. The Ocnerodrilidae, "the last of the stems" derived from the root genus of the Megascolecidae, and by the development of two pairs of external calciferous sacs in ix and x, is thought to have originated in tropical or subtropical Africa from whence it "radiated off branches to America on the west and India on the east" (Stephenson, 1930, p. 835). The eastern branch is composed of *Maheina* with a supposedly endemic species on the Seychelles, *Curgia* with a supposed endemic in South India, and *Malabaria* with endemics in India and Burma. *Malabaria* with calciferous sacs reduced to vestigial structures

[1] Oesophageal diverticula are characterized as follows, "no conspicuous calciferous glands, its wall thickened and vascular in viii–x, ventral wall in ix and x specially thickened with rudimentary lumen" (p. 122) and "Calciferous glands in viii–x no special pouches, its wall thick and invested with loosely connective tissue and blood capillaries, constricted intersegmentally undoubtedly being rudimentary calciferous glands, portion in ix & x thickest on ventral side with rudimentary lumen, sac-like portion about 0.4 mm. in diameter of whole sac, about 0.06 mm. in thickness of dorsal wall; thickest ventral wall about 0.17 mm." No figures. (Chen, 1938.)

concealed within the ventral wall of the oesophagus apparently is to be considered, so far as that characteristic is concerned, the most highly specialized genus of the family.

A number of questions in connection with these ideas need very careful consideration which is not possible here. It should be noted however that all of the Ocnerodrilids of the eastern branch are of the small size characteristic of so many of the species that have been transported across oceans and successfully colonized in new areas. Until after rigorous exclusion of the possibility of transportation of species of the eastern branch into the areas from which they are now alone known, endemicity in the oriental region, eastward radiation and any zoogeographical conclusions based thereon may be regarded as under suspicion. Arguments for evolution in a portion of the eastern branch by regression of the calciferous sacs to intra-oesophageal rudiments are not very convincing and a possibility that the intra-oesophageal diverticula of *Malabaria* are primitive or even without genetic organ relationship to external oesophageal sacs requires examination.

Key to the species of *Malabaria*

1. a. Holandric 2
   b. Metandric . . . . . *oryzivora* (Stephenson) 1924.
2. a. Prostate-like genital marking glands present, with apertures on xx . . . . . *paludicola* Stephenson 1924.
   b. Prostate-like genital marking glands lacking 3
3. a. Spermathecal ampulla irregularly saccular and longer than the duct . . . . . *biprostata* Aiyer 1929.
   b. Spermathecal ampulla shortly ellipsoidal and much shorter than the hypertrophied duct . . . . . *levis* (Chen) 1938.

A Mysore form, possibly specifically distinct, differs from *biprostata* and *levis* in the location of spermathecal pores in mid *bc* rather than on *b*.

MALABARIA LEVIS (Chen) ?

1938. *Filodrilus levis* Chen, Cont. Biol. Lab. Sci. Soc. Zool. XII, p. 423. (Type locality Ho-peng, Hainan Island. Types?)

Material examined. From Burmese collections:

Kungyangon, Hanthawaddy district, September, 1 aclitellate specimen. K. John.

Twante, Hanthawaddy district, September, 2 aclitellate specimens. K. John.

Kayan, Hanthawaddy district, September, 1 aclitellate specimen. K. John.

Pyapon, Pyapon district, September, 16 aclitellate specimens. Maung Ohn Maung.

Kyaiklat, Pyapon district, September, 1 aclitellate specimen. Maung Ohn Maung.

Danubyu, Maubin district, October, 2 aclitellate specimens. Maung Ohn Maung.

External characteristics. Length 40–87 mm. Diameter ca. 1 mm. Unpigmented. Prostomium epilobous, rarely proepilobous. Dorsal pores lacking. Nephropores unrecognizable (on *b* ?). The setae begin on ii on which all four couples are present; *ab* and *cd* about equal, *aa* and *bc* about equal, *dd* $ea = \frac{1}{2}C$. No epidermal modification recognizable in clitellar region at mid-dorsal incisions.

Spermathecal pores are small transverse slits on 8/9, on or just lateral to *b*. Female pores have not been identified but the sites are probably indicated by slight tumescences on or just lateral to *b* and just behind 13/14.

The male terminalia are variable. Nine specimens have paired prostatic pores, five specimens have no prostatic pores while the other worms have a single prostatic aperture on the right or the left side. Prostatic porophores are located on xvii in the region of *ab* with centers about on *b*, one or (usually) both ventral setae lacking when the porophore is present, setae present and normal when the porophore is lacking. On one specimen each porophore is a tiny, transversely placed area of shortly elliptical outline with a clearly demarcated but narrow rim central to which the surface is slightly depressed and pitted or roughened. Pores are unrecognizable on this marking which is located on an area of slight epidermal thickening that reaches anteroposteriorly towards 16/17 and 17/18. On other specimens a single minute pore may be recognizable in a slight, transversely placed, slit-like depression, the margins slightly tumescent to form anterior and posterior lips. The depression may be an early stage in development of a parietal invagination such as characterizes *Eukerria peguana*. On Pyapon worms prostatic porophores are rudimentary, even at best development, usually only a tiny conical protuberance on line *b* visible, pores unrecognizable.

Genital markings, usually present, are variable in position as shown in the table, and are often rudimentary like the prostatic porophores. At best development the marking has a smooth, flat, opaque, whitened rim and a sharply demarcated, slightly translucent, central protuber-

ance of shortly and transversely ellipsoidal appearance. The protuberance is due to the presence of a transversely placed, clear vesicle which bulges the muscular layers of the body wall rather conspicuously into the coelomic cavity, the vesicle containing a whitish coagulum.

Internal anatomy. All septa from 5/6 posteriorly are present; 6/7–8/9 thickened and probably with muscular fibres, 9/10 slightly thickened.

The gizzard, in vii (20), is elongate and with marked muscular sheen. The oesophagus in viii–x is widened, slightly constricted septally, heavily vascularized, with numerous vertical vessels clearly visible in the lateral walls. In ix the wall is thickened, especially so ventrally. Calciferous sacs are lacking, intramural diverticula unrecognizable in dissections. Posteriorly in ix at least, and possibly also in x, there is a very slight median groove on the floor of the gut. The oesophagus in xi–xii is white and without especial vascularity. The intestine begins in xii (20), the oesophageal valve anteriorly in the same segment. No typhlosole.

The dorsal blood vessel (single) is continued anteriorly to the region of the supra-oesophageal ganglia. A supra-oesophageal trunk, as large as the dorsal blood vessel, terminates posteriorly and abruptly in xi at the junction with anterior branches of the hearts of xi, and is unrecognizable anterior to 9/10. Extra-oesophageals are recognizable only in viii–xi where they are located on the ventral face of the gut close to the midventral line. On the parietes, in *bc*, on each side (1 specimen), there is in xi–xvi a longitudinal vessel. No subneural. The last hearts are in xi (20). Hearts of x and xi bifurcate dorsally, the anterior branch large, filled with blood and passing into the supra-oesophageal, the posterior bifurcation empty, white, passing to the dorsal trunk.

Nephridia are large, reaching into contact with both septa of a segment and upwards to the dorsal trunk, filling the coelomic cavities between the gut and body wall. A translucent, slender duct passes into the parietes just behind the septa, on or close to *b*. The neck is even more slender and transparent, the preseptal funnel small and almost transparent, close to the ventral parietes, about at *a*. Anterior to xii or xiii nephridia have not been found and if present must be much smaller.

The testes are delicate, fan-shaped bodies in the usual positions on 9/10 and 10/11. Paired structures resembling testes are present on the posterior face of 8/9 in a number if not all of the specimens. Male funnels are free, delicate and with no spermatozoal iridescence, at the

usual positions in x–xi. In addition there is, in a number of the worms, a pair of funnel-like structures on the anterior face of 9/10. Paired, lobed, very soft seminal vesicles are present in xi and xii (20). Vasa deferentia were not traced but in the Kungyangon specimen a slightly iridescent thread in xvi, probably a posterior portion of the left deferent duct, disappears from sight within a slight protuberance from the parietes into the coelomic cavity close to the ectal end of the prostatic duct. Prostates are nearly circular in section, flecked with whitish spots. A duct is distinguishable only by a slight translucence and absence of whitish flecks. Prostates may extend posteriorly into xxviii though long enough to reach several segments further if straightened out or they may be closely coiled and reaching anteriorly into the region of xiv–xv. In one worm the single prostate passes anteriorly into xv then posteriorly into xx and then anteriorly again. There is always a prostate for each porophore, even that on xviii.

Ovaries are present in xii in several specimens in addition to the usual pair in xiii.

The spermathecal ducts, in the Kungyangon specimen, are of about the same thickness as the prostates, with thin transparent walls except in a short portion close to the parietes, looped irregularly, slightly and irregularly constricted in part to produce a somewhat moniliform appearance, slightly widened at the ental end into a very small, spheroidal to shortly ellipsoidal ampulla only about half again as wide as the duct but sharply marked off and also transparent. The right spermatheca reaches into xix but is looped back on itself. The left spermatheca penetrates into xxiii. There are no diverticula or seminal chambers. In other worms the spermathecae are often coiled in ix or in viii.

The longitudinal musculature is uninterrupted over sites of the genital markings.

Remarks. In spite of careful searches in the most favorable months of the year only aclitellate specimens were secured. The largest worms are probably in a late juvenile or pre-sexual stage (note complete absence of iridescence on male funnels and in spermathecae and the juvenile condition of ovaries). The Kungyangon specimen appears to be more mature than the others.

Constant presence of all setae on xviii–xix and absence of epidermal modifications on those segments show that the male pores are not on xviii and xix and the disappearance of the male deferent duct into the parietes along with the prostatic duct indicates a location on xvii. It was impossible, either from dissections or sections, to determine whether deferent and prostatic ducts unite before opening to the exterior.

In *Pheretima anomala* Michaelsen 1907 abnormalities such as presence of supernumerary gonads and genital funnels as well as absence of male genital terminalia and of spermathecae have been attributed to parasitic action and it is therefore of interest to note that in one of the smallest athecal specimens of *levis* coelomic cavities of the anterior end are filled with sporozoan parasites. None of these parasites were found in other specimens. Absence of spermathecae and prostates can scarcely be attributed to immaturity.

Two specimens were sectioned by professional technicians but preservation was unsatisfactory, especially in the portion of the gut belonging to viii–x, and the material was refractory. In sections through the calciferous region of the gut a definite median groove in the thickened floor of the oesophagus is quite obvious but intramural diverticula or non-vascular spaces lined by epithelium are quite unrecognizable. Though intramural diverticula, supposedly characteristic, of *Malabaria*, have not been found the bithecal and biprostatic condition is sufficient justification for the generic identification, at least for the present.

The Burmese worms described above are clearly distinguished from the three Indian species of *Malabaria* by the hypertrophied spermathecae. Distinction from Chen's *levis* is doubtful. Assuming that the calciferous region of the gut is similar in both, the Burmese worms apparently differ only in a very slightly more lateral location of the spermathecal pores and the location of male and prostatic pores in parietal invaginations (in *levis* male and prostatic pores appear to be discrete and superficial, the male pore just median to the prostatic pore, while spermathecal pores are in *ab*). Against these rather unimportant and possibly fictitious differences are to be considered the similarities of such unusual sorts as: hypertrophied spermathecal ducts, presence of testes and male funnels in ix and of ovaries in xii, frequent absence of male genital terminalia and spermathecae.

A satisfactory diagnosis cannot be given until fully mature normal specimens with properly preserved calciferous region have been studied.

Diagnosis. Male and prostatic pores in parietal invaginations opening to exterior by transversely slit-like apertures with centers on *b*? Genital markings on 8/9 or viii, rarely on xviii, each marking containing a clear gland. Spermathecal pores on or just lateral to *b*. Setae: $ab=cd$, $aa=bc$, $dd=\frac{1}{2}$C; ventral setae of xvii lacking. Clitellum? Nephropores on *b*? Prostomium epilobous. Unpigmented. Length to 87 mm. Diameter 1 mm.

Holandric; seminal vesicles in xi and xii; an extra pair of testes and

male funnels (occasionally only?) present in ix. Male deferent ducts? Spermathecae long enough to reach posteriorly into region of xxv, duct sharply marked off from and several times longer than the spheroidal to shortly ellipsoidal ampulla.

Distribution. Hanthawaddy, Pyapon and Maubin districts, Burma. Hainan Island, China.

Variation in Burmese specimens of *M. levis*

Number.	Length in mm.	Prostatic pores present on xvii. l = left r = right	Genital Markings.	Spermathecae.	Remarks.	Locality.
1	68	l	viii, left side just behind *ab*.	Right to xix left to xxiii	Genital marking with wide rim.	Kungyangon
2	40	r & l right xviii	0	Coiled in ix	Ovaries in xii	Twante
3	52	r	viii, right side just behind *ab*	Coiled in ix		"
4	85	r & l	xviii, just in front of *ab*	Into viii		Kayan
5	87	l	viii, left side, just median to *a* and just in front of 8/9	0		Pyapon
6	65	0	8/9, median to *a*, left side	0		"
7	70	0	8/9, center just median to *a*	0		"
8	69	l	8/9, median	0	Testes and male funnels in ix	"
9	58	r & l	0	Coiled in ix		"
10	60	0	viii, left side, just behind *ab*	0	Testes and male funnels in ix, ovaries in xii	"
11	63	0	8/9, left side, center on *a*	0		"
12	52	r & l	viii, left side, just behind *ab*	Into xxv	Prostates into xxxviii	"
13	85	0	8/9, right side	0		"
14	18	r & l	0	Coiled in ix		"
15	35	r & l	8/9, left side, just median to *a*	Coiled in ix		"
16	31	r & l	0	Into viii, then to xv		"
17	54	r	8/9, right side, just median to *a*	Coiled in ix	Genital marking with wide rim	"
18	55	r	viii, right side just behind *ab*	Into xix	Genital marking with wide rim	"
19	41	l	8/9, left side, just median to *a*; xviii left side just in front of *ab*	0	Testes and male funnels in ix	"
20	34	l	8/9, left side, just median to *a*	Into xxi	Ovaries in xii. Genital marking with wide rim	"
21	40	r & l	8/9, right side, just median to *a*	Into xi		Kyaiklat
22	38	r & l	0	Coiled in ix		Danubyu
23	49	l	8/9, left side, center just median to *a*	Into xxi	Prostate 5 mm. long	"

Malabaria species

Material examined. From Indian collections:

Bangalore, South India, 1 juvenile and 3 aclitellate specimens. Prof. C. R. N. Rao.

External characteristics. Length to 61 mm. Diameter to 1½ mm. Unpigmented. Dorsal pores lacking. Setae begin on ii; on xx, $ab=cd$, $aa>bc$, ventral setae of xvii lacking.

Spermathecal pores are on 8/9 with centres at mid *bc*. Female pores probably are on *b* close to 13/14. Male porophores are transversely placed, rather translucent, slightly protuberant areas on xvii with centres on or close to *b*, the appearance suggestive of a clear gland in a parietal invagination but with the latter practically in the initial stage of development. Each protuberance is at the center of a circular area of epidermal whitening that extends well into *bc* and *aa*. On one specimen with especially marked protuberances there is on each side a transversely slit-like invagination in which clear glands apparently are lacking.

A single genital marking like a clear vesicle of *levis*, presetal in *ab*, is present on the left side of ix of the juvenile specimen.

Internal anatomy. A rudimentary gizzard is present in vii. The intestine begins in xii. No typhlosole. The floor of the gut in ix is markedly thickened. In x the gut wall is slightly thickened but not especially so ventrally. Intramural diverticula if present were unrecognized.

A supra-oesophageal trunk is present in ix-xi. Extra-oesophageals pass onto the ventral surface of the gut in ix. Hearts of x–xi are latero-oesophageal.

Nephridia are large from xiv posteriorly, small in xiii, unrecognizable anteriorly.

Male funnels are present in x and xi and seminal vesicles in xii. Prostates extend into lii but are long enough to reach much further. The vas deferens disappears from sight in a circular patch of parietal thickening into the center of which the prostatic duct passes. In the juvenile specimen there are no prostates or parietal modifications in xvii and the male deferent duct apparently passes into xxiii where it disappears from sight just behind the ventral setae. In this specimen all setae of xvii-xix are present.

The spermathecal duct is about as long as the ampulla, the ectal half thickened and with slight muscular sheen. The ampulla is of shortly elliptical outline, flattened and clearly marked off from the duct.

Remarks. The worms were so soft that they broke apart during study of external characteristics or in course of dissection, thus preventing more adequate characterization. Assuming that the structure of the gut in x–xi is such as to warrant generic identification as *Malabaria* (there is no other bithecal genus without calciferous sacs), the more lateral location of the spermathecal pores appears to indicate specific distinctness from forms already named.

The continuation of the male deferent ducts posterior to the male pore segment as if in search of nonexistent prostates, in the juvenile specimen, is an exact parallel of a condition frequently characteristic of aprostatic individuals of *Pheretima anomala*.

Genus Ocnerodrilus Eisen 1878

Ocnerodrilus occidentalis Eisen

1878. *Ocnerodrilus occidentalis* Eisen, N. Acta Soc. Upsala, (3), X, (4), p. 10. (Type locality Fresno County, California. Types?)

Material examined. From Burmese collections:

Rangoon, Hanthawaddy district, September, 3 clitellate specimens. K. John.

Kayan, Hanthawaddy district, September, 1 clitellate specimen. K. John.

Taik-kyi, Insein district, September, 1 clitellate specimen. K. John.

Wanetchaung, Insein district, September, 1 clitellate specimen. K. John.

Toungoo, Toungoo district, October, 1 clitellate specimen. K. John.

Rangoon, Hanthawaddy district, June, 1 clitellate specimen. K. John.

External characteristics. Length 20–23 mm. Diameter 1 mm. Unpigmented. Prostomium? (Buccal cavity everted and first two segments softened.) Dorsal pores lacking. Nephropores? The setae begin on ii on which all four couples are present; on segments just behind the clitellum *ab* and *cd* are about equal, $aa < bc$. The clitellum is dark reddish, annular, not protuberant, boundaries not clearly demarcated but probably extending from a postsetal portion of xiii to 20/21; intersegmental furrows lacking, setae present. There are no spermathecal pores. The female pores are transversely placed slits on xiv, on *b*, probably about midway between the setal arc and site of 13/14.

The male pores are on xvii at the ventral ends of tiny, conical protuberances from the central portions of nearly circular, fairly sharply demarcated porophores extending from a lateral portion of *aa* into the median portion of *bc*, the male pores just lateral to *b*. Just median to the male pore on the right side of one specimen there are visible the

tips of two setae, *a* and *b*, but on the left side of the same worm only one seta is visible.

Internal anatomy. A vertically placed glandular mass on each side of the oesophagus in vii and viii is characterized by an iridescent appearance. Between 6/7 and the posterior end of the pharyngeal bulb there are further iridescent masses. In vi–vii the gut is widened and with stronger wall but no especial muscularity is recognizable. The oesophagus in ix is dorsoventrally flattened and rather broad. Into the lateral face of this portion of the gut there passes on each side the very short stalk of a rather pear-shaped, relatively large calciferous sac which hangs ventrally beneath the oesophagus. The intestine begins in xii. No typhlosole.

The dorsal blood vessel (single) is continued anteriorly into the region of iii. A supra-oesophageal trunk is present in ix–xi. The hearts of x–xi bifurcate dorsally, the anterior branch passing onto the gut, the posterior branch to the dorsal trunk. No subneural.

Nephridia of the Rangoon worms are flattened out against the body wall, in contact with both septa of a segment, extending from *b* well towards the mid-dorsal line. A portion of each nephridium has a yellowish, translucent and granular appearance. From xi anteriorly the yellowish investment is lacking and from xiv anteriorly the nephridia are smaller though still flattened out against the body wall. Nephridia of the Kayan worm are small, slender loops, not flattened, not in contact with either septum of a segment, and with no or almost no granular investment.

The male funnels, two pairs, are free, each funnel with a brilliant orange-red irideseence. The testis sacs, in x and xi, are vertical structures reaching upwards into contact with the dorsal blood vessel. There are no seminal vesicles. The elongately tubular prostates, circular in cross section, extend back into xxv or xxvi but are long enough to reach into xxviii–xxx when uncoiled. A duct is scarcely recognizable. The vas deferens on each side passes into the parietes just anterior to the ectal portion of the prostate, union of deferent and prostatic ducts within the parietes. No setal follicles are visible in the neighborhood of the ectal portion of the prostate nor splits in the longitudinal musculature such as might indicate the presence of setae.

Ovaries are large but with few though large ova. Oviducal funnels are rather large and have thick rims.

Remarks. The June specimen from Rangoon differs from the other worms as follows: clitellum light yellowish, male pores minute apertures of about the same size as openings into setal follicles, on xvii,

very slightly posterolateral to *b*, no porophores, no modification of epidermis around the male pores, setae *a* and *b* of xvii present on both sides; prostates short, nearly straight, transversely placed, smaller than the nephridia. The worm appears to be only a slightly abnormal specimen of *occidentalis* but the shortness of the prostates is suggestive of Eisen's var. *arizonae*.

Distribution. Probably widely distributed throughout tropical and subtropical regions, already recorded from North America, West Indies, Africa, China, India and Burma (Hanthawaddy, Insein and Toungoo districts).

Genus Thatonia gen. nov.

Diagnosis. Male pores on xviii. Quadriprostatic, prostatic pores on xvii and xix, at termini of seminal grooves. Quadrithecal, spermathecal pores on 7/8 and 8/9. Setae closely paired. Gizzard in vii. Holandric; seminal vesicles in xi and xii.

Genotype. *Thatonia gracilis spec. nov.*

Distribution. Burma.

Remarks. Close to *Malabaria* from which it is distinguished at present by the acanthodriline male terminalia and the presence of spermathecae opening to the exterior in 7/8. Distinction from *Malabaria* may be questioned. In view of the apparent uniformity of the microscolecine male terminalia and the bithecal condition in *Malabaria*, as well as the apparent validity of such distinctions for generic definition elsewhere in the Ocnerodrilidae and also in other families, generic status seems preferable to inclusion in *Malabaria*.

According to orthodox oligochaete phylogeny, *Thatonia* with a quadrithecal battery, acanthodriline male terminalia and single gizzard is primitive but with regard to the calciferous portion of the oesophagus is highly specialized. Comment on the last assumption has been made in connection with *Malabaria*. A possibility that the primitive ancestral Ocnerodrilid had no gizzard may well be worthy of consideration.

Thatonia gracilis spec. nov.

Material examined. From Burmese collections:

Taungzun, Thaton district, September, 1 clitellate specimen. K. John.

Kyaikto, Thaton district, October, 3 aclitellate and 1 clitellate specimens in poor condition. K. John.

Thongwa, Hanthawaddy district, September, 21 juvenile and 5 aclitellate specimens. K. John.

Kayan, Hanthawaddy district, September, 4 aclitellate specimens. K. John.

Kyaiklat, Pyapon district, September, 8 aclitellate specimens. Maung Ohn Maung.

Maubin, Maubin district, September, 2 juvenile specimens. Maung Ohn Maung.

Danubyu, Maubin district, October, 6 partially clitellate specimens. Maung Ohn Maung.

Ingabu, Henzada district, October, 1 aclitellate specimen. Maung Ohn Maung.

Zalun, Henzada district, October, 2 aclitellate specimens. Maung Ohn Maung.

Henzada, Henzada district, October, 17 partially clitellate specimens. Maung Ohn Maung.

External characteristics. Length 63–87 mm. Diameter *ca.* 1 mm. Unpigmented. Prostomium proepilobous or epilobous. No dorsal pores. Nephropores have not been identified definitely but may be on or near *b* at the anterior margins of the segments. The setae begin on ii on which all four couples are present; behind the clitellum *ab* and *cd* are about equal, *aa* a trifle larger than *bc*, *dd ca.* = ½C; ventral setae of ii, iii or iv to ix, x, xi or xii enlarged, especially so on viii or viii and ix, lateral setae of the preclitellar segments also somewhat larger than on the postclitellar segments but not as large as those of the ventral couples.

The clitellum is light yellowish, saddle-shaped, not protuberant, reaching ventrally to *b*, extending from 12/13, a posterior portion of xiii or 13/14 to 22/23, onto xxiii or even to 23/24, anterior and posterior limits practically unrecognizable externally but clearly visible at the mid-dorsal incision; intersegmental furrows lacking, setae present. The ventral margin of the clitellum may be unrecognizable or practically so or the non-clitellar mid-ventral region may be distinguished by a white appearance which ends abruptly at or near *b*.

Actual spermathecal apertures have not been seen on most specimens but are represented by transversely slit-like depressions on 7/8 and 8/9 with anterior and posterior margins swollen and lip-like, the centers of the depression in *ab*. On one worm from Danubyu a single spermathecal pore is clearly visible as a small, transversely placed slit

on the ventral face of a markedly protuberant, almost spheroidal swelling. The female pores are on or just lateral to *b*, just behind 13/14.

The genital shield is longitudinally placed, slightly raised, whitish, extending when completely developed from or just behind 16/17 to or nearly to 19/20, widest on xvii and xix where it reaches into *bc*, occasionally nearly to mid *bc*, narrowest on xviii where it may or may not reach to *a* or *b*. The shield is fairly sharply demarcated on the most mature specimens and presumably is an area of epidermal thickening though this is scarcely visible in incisions through the male region, except around the prostatic pores where the body wall is certainly thickened. On less mature specimens there are two longitudinally placed greyish translucent bands extending anteroposteriorly between the setal arcs of xvii and xix in *ab* but bent mesially on xviii. As a result of this median bending on xviii the shield appears to have a rather H-shaped marking. On more mature specimens the greyish bands may be median to *a* and are depressed, with an appearance of rather wide seminal grooves. The prostatic pores are at the termini of the grooves, usually just in front (xvii) or just behind (xix) the ends of the grooves. The male pores, smaller than the prostatic apertures, are on xviii, anteromedian to *a*, on the median margin of or just median to the groove.

On the youngest juveniles the ventral setae of xvii and xix are present. Epidermal modifications in the vicinity of these setae are either lacking or so slight as to be unrecognizable with high magnification and brilliant illumination. Yet in two such specimens, on dissection, two pairs of prostates were found, each gland about one half mm long. Presumably then some epidermal modification has taken place even though unrecognized. On older juveniles the *b* setae or more rarely the *a* setae alone are lacking on one or both segments, or the ventral couples of both segments may be missing. The only epidermal modification recognizable on these worms is a slight tumescence at the sites of the missing setae. On partially clitellate specimens the setae are probably also lacking though on an occasional specimen tiny black dots in the epidermis do look like tips of retracted setae. Ventral setae of xviii are usually present, possibly always, but are small and at times difficult to identify.

Internal anatomy. All septa from 5/6 posteriorly are present; 5/6–8/9 thickened and with muscular fibres.

In iv–viii, on each side of the oesophagus there are masses of iridescent glandular (?) material. The gizzard is in vii (10), spheroidal or shortly ellipsoidal, much longer and thicker than the portion of the gut

in viii, usually with only slight muscular sheen but with thick and strong wall. In ix and x the gut is markedly moniliform, constricted septally, much wider than in xi–xii, the wall thickened and extensively vascularized. The floor of the gut in ix may be thicker than the rest of the wall or such thickening may be unrecognizable. There are no calciferous sacs nor are intramural diverticula recognizable. Occasionally there is visible on the floor of the gut in ix a slight, longitudinally placed groove at the median line, the groove not reaching anteroposteriorly to the segmental limits. On the inner wall of the oesophagus in xi there are several thick but low, longitudinal whitish ridges. The intestine begins in xii (15), the valve anteriorly in the same segment. There is no typhlosole. In the region of the prostates the gut may be much narrowed in one or two segments and with a series of transversely placed, unpaired ventral caeca just behind the narrowed region, one caecum in each segment. These conditions were noted in specimens in which the prostates are most compactly coiled—having been unable to push posteriorly. Possibly the supposed ventral caeca are merely the result of unusually deep ventral constriction of the intestine by the septa.

The dorsal blood vessel (single) is continued anteriorly to the region of the supra-pharyngeal ganglia. A supra-oesophageal trunk is present in viii–xi, in the posterior portion of xi bifurcated, the branches passing ventrally on the lateral faces of the oesophagus. The ventral trunk bifurcates just in front of the anterior margin of the subpharyngeal ganglia, the branches passing laterally on the parietes. The extra-oesophageal trunk is first visible as a small vessel on the parietes parallel and slightly lateral to the nerve cord, just anterior to 5/6 receiving a larger vessel from the lateral and dorsal parietes, passing upwards on 5/6 and into vi where it is lateral to the gut as in vii. In viii the trunk is slightly lower, posteriorly in viii or anteriorly in ix passing onto the ventral face of the gut close to the median line whence it is continued into xii. In some specimens each trunk apparently ends by merely disappearing from sight in the posterior part of the segment, in other worms the trunk passes off from the gut in an anterior portion of xii (with no visible continuation posteriorly on the gut) and to the parietes where it runs posteriorly for a short distance parallel and slightly lateral to the nerve cord. No subneural. The hearts of x and xi bifurcate dorsally, one branch passing to the dorsal vessel, the other to the supra-oesophageal (4), both branches empty, white and slender. Commissures of ix can be traced to the dorsal trunk only. The last pair of hearts is in xi (15).

The nephridia from xxii or xxiii posteriorly are large, thick, transversely placed, almost rectangular, compact discs in which looping is scarcely recognizable, in contact with both septa of a segment, extending from *a* to or nearly into contact with the dorsal blood vessel and filling all of the space between the body wall and the gut. A very slender duct (?) passes into the parietes in a presetal portion of the segment at or near to *b*. In an occasional segment of each of several specimens a narrow, neck-like region of a nephridium passes mesially just anterior to the duct nearly to the nerve cord and then turns anteriorly and penetrates not only through the septum but also through septa of the next three or four segments, finally terminating in a bulbous swelling just in front of a septum, the swelling single or in two distinct lobes, in either case quite funnel-like in appearance. Preservation is too poor to warrant further description. In several other specimens structures that appear to be funnels with normal relations to the anterior septa of the segments were found. In xv to xxii or xxiii the nephridia are transversely placed loops, rather delicate, and with a few tiny patches of transparent granular material. In xiv and xiii nephridia are still smaller but readily recognizable. In xii–x or ix nephridia are much smaller, poorly preserved and often lost in washing out masses of coelomic coagulum. From ix or viii anteriorly nephridia have not been found.

The male funnels are free in x and xi, well developed but with no spermatozoal iridescence (15). Small disc-like bodies in the usual locations on the posterior faces of 9/10 and 10/11 appear to be testes. Seminal vesicles of xi reach into contact over the dorsal blood vessel and fill the available space in the coelomic cavity of the segment. Vesicles of xii, in the most mature worms are much larger, in contact above the dorsal trunk and pushing 12/13 and 13/14 back into contact with 14/15. The deferent duct passes lateral to the prostatic duct of xvii and penetrates into the body wall in xviii anterior to seta *a*. The prostates are long, coiled into a compact mass extending through several segments or penetrating posteriorly alongside the nerve cord into the region of l–lx. The margins are somewhat irregular and the surfaces are flecked with whitish spots. The mottled appearance is due to a close crowding of granules in certain cells. The glands are one-cell thick posteriorly. Ducts are slenderer than the glands and may be looped in a rather zigzag fashion, passing into the parietes in xvii and xix in *ab*. A circular region in the body wall into the center of which the duct passes is firm but not protuberant. The ectal portion of the duct can be pulled out from the parietes, apparently intact.

The spermathecae are large, coiled, in viii and ix, reaching into contact with the dorsal parietes. The ampulla which is elongately tubular (length 3+mm.) has a rather thin and translucent wall. The duct is very much shorter than the ampulla and slightly narrower, the wall thick and lumen narrow but slightly irregular, the duct slightly widened as it passes into the parietes. No diverticula or seminal chambers. Spermatozoal iridescence has not been observed in any of the spermathecae.

Abnormalities. A number of the worms appear to be abnormal. Of these 17 are posterobiprostatic, the anterior prostates lacking, the genital shield with no anterior widening and ending at or just in front of the site of 17/18, the seminal grooves terminating slightly in front of the male pores. On these specimens (three from Kayan, one from Taungzun, three from Thongwa, one from Zalun, one from Ingabu, three from Danubyu, and five from Henzada) the ventral setae of xvii are present. On three worms one prostate only of xvii is lacking, the anterior widening of the shield lacking on the side of the missing prostate, the seminal groove of that side terminating anteriorly just in front of the site of 17/18, the ventral setae of the abnormal side present (left prostate lacking in two worms from Danubyu, the right lacking in one from Zalun).

Another worm is much more abnormal, the right half of the genital shield about one mm behind the left half, four spermathecae on the left side two of which are in one segment.

Remarks. After two failures a complete series of transverse sections (10 u thick) through the calciferous portion of the gut were obtained. In spite of the fact that the specimen had been killed and preserved without benefit of special fixation for histological purposes the preservation must be considered good. Vascular spaces in the thickened floor of the oesophagus are completely filled with blood. There are no vertical clefts in regions between vascular lamellae (as in *Malabaria, vide* fig. 38, pl. 33, Stephenson 1924). In the thickened floor of the gut are numerous branching canaliculi, mostly seen in transverse section. The thickness of the wall of each canaliculus is about the same as the diameter of the lumen, the wall very sharply outlined as if by a definite membrane both externally and internally (next to the lumen). Nuclei and cell walls are quite unrecognizable. In just one section there is visible close to the ventral surface of the gut wall and at both sides of a median, vertically placed, blood mass, a pair of spaces similar to those marked "x" in Stephenson's fig. 39. In other sections one or both of these spaces is lacking or one of the spaces may be replaced by

two or even three smaller spaces. Each of the larger spaces (canals) is also provided with a wall sharply marked off externally as well as next to the lumen and with no nuclei or cell walls recognizable. These canals appear to be formed by junction of the smaller canaliculi. None of the canals or canaliculi have been traced into the gut lumen.

In two consecutive sections (and here only), midway between the outer and inner surfaces of the floor of the oesophagus there is a pair of larger spaces, one on each side of the median plane. The walls of these spaces are not as sharply marked off as those of the canals and canaliculi but are cellular with about ten fairly large nuclei recognizable in each section. The width of this cellular wall is much less than that of the lumen which is filled by a fine, webby material. There is no median groove in the floor of the gut in the region of the sections containing the canals or the cell-lined spaces.

Much thinner sections will be necessary for elucidation of the relationships of canaliculi, canals and cell-lined spaces but with the canaliculi ramifying throughout the floor of the gut there is nothing particularly suggestive of external calciferous sacs reduced to diverticula and retracted, as it were, into the floor of the gut.

Blood in the vascular spaces of the floor of the gut is stained as elsewhere a bright red but blood in the vascular spaces of the roof of the gut is uniformly unstained and of a greenish-translucent appearance which is retained clear to the dorsal surface where the red coloration again appears.

Diagnosis. Seminal grooves in or median to *ab*, bent mesially on xviii to produce a rather H-shaped figure, on a genital shield extending nearly to 16/17 and 19/20. Prostatic pores on setal arcs and at termini of seminal grooves, male pores anteromedian to *a*. Spermathecal pores in *ab*. Clitellum saddle-shaped (?), on xiii–xxii or xxiii. Setae: $ab=cd$, $aa>bc$, $dd=\frac{1}{2}$C; ventral setae of xvii and xix lacking, setae of some preclitellar segments enlarged, especially *a* and *b*. Prostomium epilobous. Unpigmented. Length 63–87 mm. Diameter 1 mm.

Spermathecal ampulla much longer than the duct, tubular, coiled; duct slightly widened just prior to entrance into parietes.

Family MEGASCOLECIDAE

Genus Woodwardiella Stephenson 1925

In an earlier paper (Gates, 1938, p. 428) it has been pointed out that several Indian species hitherto included in the genus *Woodwardiella*

must be transferred to other genera. One such transfer has already been made, and the exclusion of others leaves but four species in the whole area west of Australia. Of these two may be identical, and all may have been exported from Australia. A Ceylonese species, *W. uzeli* (Michaelsen) 1903, known only from a rather brief description that contains at least one error (with regard to the setal ratios), is distinguished from Indian and Burmese forms by a more posterior location of the first dorsal pore (?), location of spermathecal pores lateral to *b* and just behind 7/8–8/9, constant presence of post-setal papillae on xvii "in den Borstenlinien *b*", presence of paired female pores, and the presence of a typhlosole (location of last hearts unknown).

Australian species are so variable with respect to characteristics that may be of generic importance (such as presence or absence of calciferous glands) as to indicate a need for further revision of the remaining and larger portion of the genus. Most species are so inadequately characterized that such revision is inadvisable until further studies of internal anatomy have been made.

Woodwardiella javanica (Michaelsen)

1910. *Woodwardia javanica*, Michaelsen, Mitt. Mus. Hamburg, XXVII, p. 93. (Type locality Buitenzorg, Java. Types in the Hamburg Museum.)

Material examined. From Burmese collections:

Boyagyi, Thaton district, October, 4 aclitellate and 4 clitellate specimens. K. John.

Mupun, Amherst district, October, 1 clitellate anterior fragment. K. John.

External characteristics. Length, 55–75 mm. Diameter, 1–1¼ mm. Unpigmented. Prostomium proepilobous. Nephropores not seen. The first dorsal pore is on 6/7 (6).

The setae begin on ii; the setal ratios on xx are, so far as can be determined, about the same as on *pumila*, $ab<aa<$or$=bc<cd$, $dd=$or slightly greater than aa, posteriorly $dd<aa$. Anterior to the clitellum *d* seems to be more dorsal than on *pumila*.

The clitellum is usually slightly protuberant, light brownish, annular, extending from 13/14 or from some portion of xiii to 17/18; intersegmental furrows and dorsal pores lacking, setae present but deeply retracted and scarcely visible.

Quadrithecal, spermathecal pores minute and superficial, on 7/8–8/9, on or immediately lateral to *a*.

A single, median female pore is visible just anterior to the setal arc of xiv, on two clitellate and two aclitellate specimens.

The male pores (common apertures of the prostatic duct and penisetal follicles) are at the centers of small, slightly protuberant, rather indistinctly demarcated porophores of circular to shortly elliptical outline (in the latter case transversely placed), each porophore about as wide as *ab*, the center of a porophore slightly lateral to *a* to just median to *b*.

Genital markings apparently are lacking, but markings like those of *pumila*, if present, would be unrecognizable on most of these specimens.

Internal anatomy. Septum 5/6 is membranous to slightly muscular; 6/7–11/12 muscular; 12/13 slightly muscular.

The gizzard is in v (7), with brilliant muscular sheen. The oesophagus, behind the gizzard, is slightly constricted by the septa and hence somewhat moniliform, the inner wall in vii–xiii or xiv provided with low, longitudinal non-lamelliform ridges, these ridges crossed in vii–ix or viii–ix by circular furrows to mark off rather low, almost conical protuberances. The intestine begins in xviii (7), the part in xviii rather conical, with narrow portion anteriorly, full intestinal width attained only at 18/19. The valve is in xvii or a posterior portion of xvii and the anteriormost part of xviii, and is unusually narrow. The intestine may be slightly constricted at 18/19 but does not have a valvular structure at the constriction. There is no typhlosole (5).

The dorsal blood vessel (single) is continued anteriorly to the region of the cerebral ganglia. A supra-oesophageal is present in vii–xiii, disappearing from sight at 6/7 and 13/14, as large as the dorsal blood vessel when distended with blood, occasionally empty and then unrecognizable. Extra-oesophageals are present, apparently much as in *pumila*, but are always empty in part and then unrecognizable. In xiv–xviii, on each side there is usually visible a fairly large, lateroparietal trunk which passes mesially just anterior to 13/14 and into the extra-oesophageal trunk. In one worm the right lateroparietal vessel terminates abruptly in xv, but a large branch from the left vessel passes underneath the nerve cord to the right side in xvi and then posteriorly into xviii. In one specimen each lateroparietal trunk bifurcates just anterior to 13/14, the larger branch passing to the extra-oesophageal trunk, the smaller passing up onto the dorsal face of the gut. No subneural. The last pair of hearts is in xii (7). The hearts of x–xii bifurcate dorsally, one branch passing into the supra-

oesophageal trunk, the other to the dorsal vessel. Commissures of ix may be as large as the hearts. The commissures of ix and the hearts of x–xii have been traced to the ventral trunk, the commissures of viii–vi not so traced.

The nephridia from xix posteriorly are flattened out against the parietes, in contact or nearly so with both septa, extending from *a* or *b* to *c*. The nephridia of xviii are small and anterior to the prostatic duct. In xvii–xiv of the aclitellate specimens the nephridia are also flattened (decreasing in size anteriorly) while in the clitellate specimens the nephridia are not flattened but look like clusters of micronephridia. In xiii–v the nephridia are on the anterior faces of the septa, small in xiii–ix, slightly larger in viii–vii, large and like clusters of pharyngeal micronephridia in vi–v. In the postprostatic segments the body wall is covered with a layer of coelomic coagulum (?), as in *pumila*.

The male funnels are free in x and xi. The seminal vesicles are fairly large, in contact above the dorsal blood vessel, or reaching to the dorsal trunk, paired in xi and xii; each vesicle acinous, the lobes pear-shaped, the narrowed central portions rather loosely bound together. Segments x and xi are filled with a delicate coagulum in which the anterior vesicles are imbedded. The vesicles are soft, especially in xi of clitellate worms, and may be destroyed in removing the coagulum. The prostates are confined to xviii, slightly dislocating 17/18 and 18/19, or just penetrating into xvii or xix. The duct is 1½–2 mm. long, bent into a U-shaped loop or coiled, the ectal half thicker but the whole duct with a brilliant muscular sheen.

On the posterior face of each prostatic duct there are two penisetal follicles, the follicles united at the ental ends, diverging ectally to pass into the parietes separated by a strand of longitudinal musculature. Each follicle contains one functional seta and often a shorter reserve seta. The setal shaft is variously curved, occasionally with two or three curvatures on a single seta. The tip is flattened and narrowed, thin and usually bent over to one side, tapering to a sharp point (triangular tip). The margins of the ectal half of the shaft are sinuous, the sinuosities alternating on opposite sides of the shaft as if due to a groove running in a spiral fashion around the shaft. In each sinuosity towards the tip and close against the shaft a rather triangular tooth is recognizable with oil immersion objective. After drying or twisting of the shaft, teeth may stand out much more conspicuously. Measurements (in mm. by Miss Chapman) are given below.

PENIAL SETAE

Seta	*Length*	*Width base*	*Width midshaft*	*Width tip*	*Thickness at side*
a	0.60	0.006	0.005	0.0015	0.001
b	0.58	0.006	0.005	0.002	0.001
b(r)	0.32	0.003	0.002	....	0.001
a	0.69	0.007	0.005	0.002	0.001
b	0.63	0.006	0.004	0.002	0.001
b(r)[1]	0.41	0.006	0.004	0.002	....
a	0.60	0.005	0.004	0.001	....
b	0.63	0.006	0.004	0.002	....
b(r)	0.15	0.002	0.002	....	....
a	0.55	0.005	0.005	0.002	....
a(r)	0.40	0.004	0.004	0.001	....
b	0.59	0.006	0.004	0.002	....
b(r)	0.47	0.007	0.005	0.002	....
a	0.63	0.007	0.005	0.003	....
a(r)	0.36	0.003	0.003	....	....
b	0.62	0.007	0.006	0.002	....
b(r)	0.23	0.003	0.002	....	....

[1] Ornamentation continued two thirds way down the shaft. (r) reserve.

The spermathecae are large, reaching up into contact with the dorsal parietes. The duct is much shorter than the ampulla. In the ectal half, almost confined to the parietes, the lumen is very narrow and with a smooth wall of high epithelium surrounded by a muscular (?) layer of about the same thickness. Entally the duct is slightly and gradually widened, the lumen enlarged but irregular. This ental portion of the duct is not marked off externally from the ampulla which is also gradually widened entally, the duct distinguished in cleared spermathecae by the thicker wall. The elongate and slenderly club-shaped diverticulum which passes into the lateral face of the duct just above the parietes is about as long as half the combined lengths of duct and ampulla. There is no external demarcation into seminal chamber or stalk, the latter only slightly narrower than the chamber and recognized by the thicker wall and narrow lumen. The chamber is about as long as the stalk, the sperm mass in the latter straight or slightly looped or even with an appearance of slight spiral coiling entally. The diverticulum opens into the widened lumen of the ental portion of the duct, immediately above the aperture into the narrowed lumen.

Remarks. The worms are not well preserved, softened just behind the clitellum, the clitellar region as well as a short portion just behind and just in front roughened. Two of the aclitellate specimens, with spermatozoa in the seminal chambers of the spermathecae are probably postsexual.

W. javanica has been known hitherto only from the types, the original description not quite as complete as is now desirable. There is however no evidence to indicate that the Burmese worms should be distinguished taxonomically from the types. Michaelsen presumably missed the delicate anterior vesicles imbedded in the testicular coagulum. Seminal vesicles are certainly lacking in ix in the Burmese worms.

W. javanica is close to *W. callichaeta, affinis, libferti,* and *molaeleonis* (Michaelsen) 1907, being distinguished from these southwest Australian species mainly by the presence of a single female pore, and the location of the anterior seminal vesicles in xi rather than ix. Earthworms of the Australian region, of the small size of *javanica,* are doubtless very imperfectly known. It is therefore possible that both the Java and Burma records indicate importations from some eastern portion of the Australasian region.

Diagnosis. Quadrithecal, spermathecal pores on 7/8–8/9, on *a.* Male pores in *ab,* on xviii, each pore at center of a small, circular to shortly elliptical porophore that is about as wide as *ab.* Female pore median. Seta *d* dorsal, behind the clitellum close to the mid-dorsal line so that $dd < aa$. First dorsal pore on 6/7. Unpigmented. Length 38–75 mm. Diameter 1–1⅓ mm.

Gizzard in v. Intestine begins in xviii. Hearts latero-oesophageal, in x–xii. Holandric; seminal vesicles in xi–xii. Prostatic duct 1½–2 mm. long, looped or coiled. Spermathecal duct much shorter than the ampulla, diverticulum about half the length of main axis, into lateral face of duct near the parietes. Penial setae 0.55–0.69 mm. long, 0.005–0.007 mm. thick at base, 0.004–0.006 at midshaft, 0.0015–0.003 across flattened tip; margins of ectal half of shaft sinous, sinuosities alternate and at least ectally containing each a rather triangular tooth.

Distribution. Boyagyi, Thaton district; Mupun, Amherst district, Burma; Buitenzorg, Java.

Woodwardiella pumila Stephenson

1931. *Woodwardiella pumila*, Stephenson, Proc. Zool. Soc. London, 1931, p. 51. (Type locality Bhamo. Type in the British Museum.)

Material examined. From Burmese collections:

Sittang, Thaton district, October, 3 aclitellate specimens. K. John.

Pegu, September, 2 aclitellate and 44 clitellate specimens. K. John.

"Jungle", west of Pegu, September, 1 aclitellate and 8 clitellate specimens. K. John.

Rangoon, Hanthawaddy district, June, 32 clitellate specimens; September, 45 clitellate specimens; February, 1 aclitellate and 8 clitellate specimens; March, 27 clitellate specimens. K. John.

Kungyangon, Hanthawaddy district, September, 12 juvenile or aclitellate and 1 clitellate specimens. K. John.

Kyauktan, Hanthawaddy district, September, 2 aclitellate specimens. K. John.

Thameintaw, Pyapon district, September, 1 clitellate specimen. Maung Ohn Maung.

Pyapon, September, 1 clitellate specimen. Maung Ohn Maung.

Danubyu, Maubin district, October, 3 juveniles. Maung Ohn Maung.

Wakema, Myaungmya district, October, 3 aclitellate and 1 clitellate specimens. Maung Ohn Maung.

Myaungmya, October, 6 aclitellate specimens. Maung Ohn Maung.

Bassein, October, 1 juvenile and 2 clitellate specimens. K. John.

Thinbawgyin, Bassein district, October, 1 aclitellate specimen. K. John.

Padaukchaung, Bassein district, October, 1 aclitellate specimen. K. John.

Toungoo, October, 4 juvenile specimens. K. John.

External characteristics. Length, to 76 mm. Diameter 1 mm. Unpigmented. Prostomium proepilobous, occasionally a single median furrow continued from the posterior margin of the prostomium along the mid-dorsal line towards 1/2. Nephropores were not seen.

The setae begin on ii on which all four couples are present (10). Anterior to the clitellum seta *d* is mid-lateral or perhaps a trifle on the dorsal side, from xvii or xviii posteriorly definitely dorsal. On xx, $ab<aa<$ or $ca.=bc<cd>dd$, $dd=$ or $>aa$, but only a few segments posteriorly *dd* becomes smaller than *aa*.

The first dorsal pore is on 6/7 (18), but on a few other worms the rather pore-like marking on 6/7 may be imperforate.

The clitellum is usually slightly protuberant, reddish to brownish, setae present, dorsal pores (except that on 13/14) and intersegmental furrows lacking; annular, extending from 17/18 to a presetal portion of xiv, 13/14, a postsetal portion of xiii or even slightly onto the presetal half of xiii. The anterior boundary of the clitellum is often quite vague.

Quadrithecal, spermathecal pores minute and superficial, on 7/8–8/9,

on *b* or in *ab*. The location of the pores is variable from one side to the other, from one segment to another and from one specimen to another. Location on *b* is perhaps the most common, just median to *b* also frequent, an occasional pore only slightly lateral to *a*.

The single female pore is median, immediately in front of the setal arc, at the center of a transversely placed, whitish area of shortly elliptical outline in *aa* (32).

The male pores are in *ab*, just lateral to *a*, at or near mid *ab*, or just median to *b*, at or near the center of small transversely placed porophores of shortly elliptical (rarely almost circular) outline that are about as wide as or a trifle wider than *ab* and which may extend to just median to *a* or just lateral to *b*, on xviii. On an occasional specimen (12) a penial seta protrudes to the exterior through the pore, the pore unrecognizable if the seta is conspicuously protuberant.

The genital marking is a transversely placed, whitened area of elongately elliptical outline on 17/18 in *aa*. The marking is not protuberant, not demarcated except by colour differences, often unrecognizable. A somewhat similar but less obvious area may be present on 18/19 but crossed by the intersegment furrow.

Internal anatomy. Septum 5/6 is present but membranous or slightly muscular; 6/7–9/10 muscular; 10/11–11/12 slightly muscular.

The pharyngeal bulb is unusually short. Between the hinder end of the bulb and the gizzard there are masses of iridescent (glandular?) tissue which come readily away from the oesophagus. The gizzard is in v (15), dislocating 5/6 posteriorly in a funnel-like fashion. On the inner wall of the oesophagus in ix–xiii there are a number of closely crowded, low, non-lamelliform ridges of a grayish translucent appearance due to the presence of blood beneath the transparent epithelium. The intestine begins in xvi (oesophageal valve anteriorly or posteriorly in xvi) or xvii (2 specimens from Sittang) but may be much narrowed in xviii or xviii and xix presumably as a result of crowding by the prostates. There is no typhlosole.

The dorsal blood vessel (single) is continued anteriorly to the region of the cerebral ganglia where it bifurcates, the two branches passing ventrally on the pharyngeal bulb to the parietes. A supra-oesophageal is present in vii to xiii disappearing just behind 6/7 (or continued into vi) and just in front of 13/14. The ventral trunk bifurcates at the anterior margin of the suboesophageal ganglia, each branch passing to the body wall where it subdivides several times. The extra-oesophageals are first recognizable as longitudinal vessels just behind the circumoesophageal nervous commissures where they are formed by the

union of two or more vertical vessels from the parietes of i–iii, each trunk receiving two connectives from the ventral vessel behind the suboesophageal ganglia, passing up to a level just below the gizzard in v, with a transverse connective to the opposite trunk in viii, passing in ix onto the ventral face of the gut close to the midventral line and thence posteriorly, breaking up into two or three branches which disappear in xiv. In xiv–xviii on each side, on the body wall under the nephridia, there is a lateroparietal trunk which may be nearly as large as the dorsal blood vessel. Immediately anterior to 13/14 this vessel passes mesially behind the heart of xiii, and then directly into the extra-oesophageal or runs upwards to the level of the dorsal face of the gut, then turning ventrally to open into the extra-oesophageal. No subneural. The hearts of x–xiii bifurcate dorsally, the anterior branch passing into the supra-oesophageal, the posterior branch passing into the dorsal trunk. The last pair of hearts is in xiii (15). The commissures of ix–v connect the dorsal and ventral trunks, the hearts of x–xiii also passing into the ventral trunk. The supra-oesophageal receives numerous vertical vessels from the lateral faces of the gut in ix–xiii but these vessels are largest in xiii.

The nephridia from xiv or xv posteriorly are flattened against the body wall, in contact with both septa, extending from *a* or slightly lateral to *a* to *c*. From xiii or xiv anteriorly the nephridia are not on the parietes but on the anterior faces of the septa, small in xiv or xiii–x, larger in ix anteriorly, especially so in v–vi and with the appearance of clusters of micronephridial tubules. In the postclitellar segments the body wall is clothed with fine, whitish threads, the appearance like that of a micronephridial fur, but no tubular structure is recognizable in the threads, the whitish material regarded as coelomic coagulum.

The male funnels are free in x and xi (10). Segment x may be filled with a loose coagulum. The seminal vesicles of xi and xii may be large, filling the coelomic cavities of their segments and reaching up into contact with the dorsal blood vessel (6), or medium-sized to small, vertically placed bodies on the posterior faces of the septa. The prostates are racemose, lobed, compact, much like *Pheretima* prostates in appearance, in xviii (4) or xviii–xix (4). The duct is less than ½ mm. long, straight, slender, usually with a slight muscular sheen that is especially noticeable ectally.

Median to each prostatic duct there are two distinct penisetal follicles. One of these passes into a cleft in the longitudinal musculature on the median face of the prostatic duct, the other passing into the

body wall slightly more mesially. A follicle usually contains one penial seta; several follicles with two setae, the second presumably a reserve seta. The length of the setae varies from 0.28–0.42 mm., the diameter at the middle of the shaft from 6–8 micra. The shaft is nearly straight or with a slight curvature of the ectal end. The ental end may be shortly curved like the handle of a walking stick in which case the shaft has a slightly bowed appearance. The tip of the seta tapers gradually to a hair-like or filamentous process which may be straight or nearly so or bent or curved to one side. Along the ectalmost portion of the seta the margins have a slightly sinuous appearance. Under the oil immersion objective the margins appear to be slightly incised as if marking off rather elongately spinelike teeth (spirally arranged?). On two setae there is an appearance of very fine, almost hair-like spines, in (5–8) circles around the shaft. Usually penial setae are not recognizable externally and when visible only one protrudes through each male pore.

PENIAL SETAE

Seta	*Length*	*Width base*	*Width midshaft*	*Locality*
f	0.31	0.006	0.007	Sittang
f	0.28	0.005	0.007	"
r	0.15	0.009	0.008	"
r	0.13	0.008	0.007	"
f	0.38	0.006	0.008	"
f	0.33	0.005	0.007	"
r	0.07	0.003	0.003	"
f	0.33	0.007	0.006	"
f	0.35	0.008	0.007	"
r	0.24	0.007	0.006	"
f	0.42	0.007	0.008	"
f	0.39	0.007	0.008	"
r	0.23	0.006	0.005	"

f functional
r reserve

The spermathecal duct is slender and usually slightly shorter than the ampulla from which it may or may not be clearly marked off externally. In an ental portion of the duct the lumen is fairly wide and filled with a dark material like that in the ampulla. Ectal to the diverticular junction the lumen appears to be very narrow and the duct wall thick but this portion of the duct usually is not satisfactorily

cleared. The diverticulum usually passes into the lateral face of the duct slightly ental to the middle of its length and is not marked off externally into stalk and seminal chamber, the latter recognizable in the cleared spermatheca by a thinner wall and the shortly ellipsoidal to sausage-shaped mass of spermatozoa within, the stalk only slightly slenderer than the chamber but with a thicker wall and a narrow lumen. In several spermathecae massed spermatozoa are continued from the seminal chamber through the stalk into the duct and in such spermathecae, when cleared, it is possible to see the diverticular lumen turn entally within the duct wall to open into the ental chamber of the duct just above the region where the duct lumen is abruptly narrowed. All spermathecae examined (from clitellate specimens) are characterized by a spermatozoal iridescence in the seminal chamber.

The ovaries are relatively large. Each ovary examined contains 10–16 full sized ova and at or near the center several much smaller ova. On the posterior face of 13/14 there are small paired sacs. In two worms these sacs were empty but in two other specimens the sacs contained ova.

Parasites. On some of the Rangoon specimens, especially on the clitellum and around the male pores, there are clusters of rotifers. These were sent to the British Museum but have not been further identified.

Abnormality. In a worm from Pyapon the dorsal blood vessel is double from the middle of xvii to 13/14, single to the middle of xiii and double to 12/13, single henceforward. The left heart of xiii is lacking in one of the Sittang specimens.

Remarks. W. pumila is very close to, if not actually con-specific with, *W. kayankulamensis* Aiyer 1929. The latter can be distinguished, according to the author's account, only by characteristics of doubtful value; more dorsal location of *d* setae on preclitellar segments, location of the male pore "in line with setae *a*", presence of "a single penial setal sac", and absence of "copulatory papillae". In contrast to his usual practice Aiyer failed to state definitely whether there is a single female pore or a pair of pores which may perhaps indicate that he did not actually see these apertures (types possibly not fully mature as there are dorsal pores on the clitellum). Copulatory papillae are certainly lacking in *pumila* but the whitened areas certainly deserve recognition as genital markings though not always recognizable, possibly due to condition.

Prof. Aiyer has kindly supplied three specimens of his species for

study but unfortunately two of these are juvenile while the other is aclitellate though nearly sexual (male funnels iridescent but no iridescence in spermathecae). On these worms female pores and genital markings are unrecognizable. Anterior to the clitellum the *d* setae are more dorsal than on *pumila*. Male porophores are unrecognizable but male pores are in *ab*. Spermathecal diverticula pass to the lateral face of the ducts except on the right spermatheca of ix of one specimen. Two penisetal follicles are present in each worm on each side, the follicles separated ectally by a distinct strand of longitudinal musculature. All follicles were removed for examination but several were lost. All setae from *a* follicles except one have truncate tips (worn?) while setae from *b* follicles have tips terminating in a spine much like that of *pumila*. Ectal portions of *a* setae at least are more strongly curved than in *pumila*. The exceptional *a* seta has a terminal spine, shorter and thicker than in *pumila*.

If *pumila* and *kayankulamensis* should prove to be conspecific, the occurrence of the species in two such widely separated localities must indicate either transference from one area to the other or importation into both areas from still a third region, presumably somewhere in eastern Australasia.

Next to *kayankulamensis*, *pumila* appears to be closest to *javanica* from which it is distinguishable by the slightly more lateral location of spermathecal pores, presence of hearts in xiii, more posterior origin of the intestine, and slightly shorter penial setae. The suggestion has already been advanced that *javanica* may be an importation into both Java and Burma from some eastern portion of Australasia.

Diagnosis. Quadrithecal; spermathecal pores on 7/8–8/9, on or slightly median to *b*. Male pores in *ab*, on xviii, on or close to the center of small, transversely placed, slightly protuberant porophores of shortly elliptical outline in *ab* or reaching just median to *a* or just lateral to *b*. Genital marking a transversely placed, whitened area of elongately elliptical outline, in *aa*, on 17/18. Female pore median. Seta *d* dorsal behind the clitellum and after the first few postclitellar segments close to the mid-dorsal line so that $dd < aa$. First dorsal pore on 6/7. Unpigmented. Length to 76 mm. Diameter 1 mm.

Gizzard in v. Intestine begins in xvi or xvii. Hearts latero-oesophageal, in x–xiii. Prostatic duct ½ mm. long, straight, slender. Spermathecal duct slightly shorter than ampulla, diverticulum into lateral face of duct nearer ampulla. Penial setae 0.28–0.42 mm. long, 0.005–0.008 thick at base, 0.006–0.008 at midshaft, tip terminating in a hair-like filament.

Genus PHERETIMA Kinberg 1867

PHERETIMA BICINCTA (E. Perrier)

1875. *Perichaeta bicincta* E. Perrier, C. R. Ac. Sci. Paris, LXXXI, p. 1044. (Types in the Paris Museum. Type locality unknown but supposed to be on Luzon or Mindoro, Philippine Islands.)

Material examined. From Burmese collections:

"Earth in large flower pots on veranda of faculty house", Judson College Compound, Kokine, Rangoon, 1 aclitellate and 7 clitellate specimens.

External characteristics. The setae of x quite definitely appear to be smaller than those of ix and xi but have not been measured. The numbers of male setae on xviii and of setae on xx are; 8, 8, 8, 7, 7, 8, 8, and 47, 48, 46, 46, 48, 46, 48. The first dorsal pore is on 12/13 (8). Female pores are paired, diagonally placed slits, each pore very slightly anterior and median to *a*. Each male pore is at or near the center of a small, transversely placed, indistinctly demarcated area with outline approximating to shortly elliptical.

Genital markings are unrecognizable. On several specimens a number of minute, greyish translucent, circular areas on the postsetal portion of xviii median to the male pore lines are recognizable under best optical conditions. These areas probably mark sites of gland pores.

Internal anatomy. Septum 9/10 is strong and does not rupture easily but is almost transparent. On the oesophagus just anterior to 9/10 there is a ring of slight protuberances, probably rudiments of glands that form a circumoesophageal collar in other species. On the inner wall of the gut in x–xiii there is on each side a series of vertically placed ridges; longitudinal ridges at the median line dorsally and ventrally not noted. In xiv and the anteriormost portion of xv the gut is narrow and provided internally with low, longitudinally placed, whitish ridges. The typhlosole begins abruptly in the caecal segment and is a simple ridge about ¼ mm. high. Passing posteriorly the typhlosole gradually decreases in height and is unrecognizable posterior to 1. There are masses of nephridia in v and vi but blood glands and lymph glands have not been found. Hearts of x–xii connect the ventral and supra-oesophageal vessels, branches to the dorsal trunk not found.

Seminal vesicles of xii are acinous, vertically placed bodies on the posterior face of 11/12, the vesicles of xi also acinous but smaller, included in the testis sac of xi. Posterior and just median to the ectal end of each prostatic duct and sessile on the parietes is a soft mass of

circular outline of glandular tissue which can be scraped away from the body wall leaving little if any evidence of its presence. There is no spermatozoal iridescence in the seminal chambers (4 specimens).

Remarks. All specimens are probably in a postsexual condition although the clitellum has regressed on one specimen. As there appears to be no variation with regard to the number of female pores the biporal condition is regarded as a specific characteristic. Although genital markings appear to be lacking masses of glandular material in xviii are termed genital marking glands since indistinctly outlined genital markings have been noted in other specimens of the species, though there apparently less marked (epidermal modification slight) and more transitory than usual.

P. bicincta has not been reported hitherto from Burma though twice recorded from India, and was not obtained in other years when plants were repotted. The original home of the species is still unknown.

Pheretima humilis spec. nov.

Material examined. From Burmese collections:

"Earth in large flower pots on west veranda of faculty house," Judson College compound, Kokine, Rangoon, September, 1936, 6 clitellate specimens (Types).

Same locality but after repotting, June, 1937, 10 clitellate specimens.

External characteristics. Length 20–23 mm. Diameter two mm. Segments; 75 (1), 78 (1), 79 (1), 80 (3). Unpigmented. Setae begin on ii on which there is a complete circle (6). Setal formulae are shown below. The first dorsal pore is on 12/13 (6). The clitellum is brownish, slightly protuberant, annular, extending from 13/14 to 16/17; intersegmental furrows and dorsal pores lacking, setae present ventrally on xvi.

Setal Formulae

v	*vi*	*xvii*	*xviii*	*xix*	*ii*	*iii*	*viii*	*xii*	*xvi*	*xx*
29	33	12	7	10	40	47	58	52	6	42
29	29	11	7	11	..	40+	56	48	6	44
26	27	12	8	12	..	..	55	50	12	40
..	..	10	8	12	..	..	..	48	11	42
..	..	11	6	10	..	..	54	49	8	38
..	..	12	8	11	..	..	57	46	6	41

Bithecal, spermathecal pores minute and superficial, on 5/6. There is a single female pore on four specimens, possibly a single pore on the

other two. Male pores have not been seen but are obviously minute and superficial, at or near centers of disc-like porophores of circular outline. No genital markings.

Internal anatomy. None of the septa are thickly muscular; 8/9 complete but membranous, 9/10 apparently lacking. The intestine begins in xv (4). Intestinal caeca are simple (4). The single heart of ix is on the right side (1) or the left side (1), a pair of hearts belonging to ix present in two specimens. The last pair of hearts is in xiii (4). All hearts of ix-xiii pass into the ventral blood vessel (2).

Testis sacs are probably unpaired and annular, except that the sac of xi in one specimen appears to be U-shaped, the limbs of the U reaching nearly to the dorsal blood vessel; hearts of x and xi included in the sacs (3), the dorsal blood vessel included in the sac of x (3) or beneath the sac (1), beneath the testis sac of xi (2). Seminal vesicles of xi are small and are included within the posterior testis sac or sacs (4). Vesicles of xii are small, vertically placed on the posterior face of 11/12, scarcely thicker than the hearts of xii. Prostates extend through xvi or xvii to xix. The prostatic duct is 1½–2 mm. long, variously twisted or bent into a U-shaped loop.

The spermathecal duct is slender, longer than the ampulla (3), the wall thick, lumen abruptly narrowed at the diverticular junction. The diverticulum which passes into the median face of the duct near to but not at the parietes is as long as or longer than the combined lengths of duct and ampulla. The ectal half of the diverticulum, the stalk, has a very narrow lumen while the ental half is marked off into three rather ovoidal, equisized seminal chambers separated from each other by short, narrow, neck-like regions, each chamber distended by a hard, practically transparent mass.

Remarks. Because of the small size, determination of characteristics of the testis sacs is difficult. The ventral blood vessel appears to be actually within the sacs but filling the lumen so that testicular coagulum is not continuous from one side to the other ventrally. If however the ventral trunk is not within the sacs, characterization must be horseshoe-shaped.

Several small bithecal species with spermathecal pores on 5/6 are known. From these *humilis* may be distinguished as follows; from *P. lompobatangensis* (Michaelsen) 1899 by absence of genital markings and of 9/10, the shape of the spermathecal diverticulum; from *P. nugalis* Gates 1931 by the shape of the testis sacs and inclusion of seminal vesicles; from *P. pusilla* (Ude) 1893 by absence of genital markings; from *P. voeltzkowi* Michaelsen 1907 by absence of genital

markings and of 9/10, the presence of hearts in xiii; from *P. wui* Chen 1935 by the absence of genital markings, the shape of the testis sacs and inclusion of seminal vesicles; from *P. zoysiae* Chen 1933 by the presence of septum 8/9, more dorsal location of the spermathecal pores and the larger number of spermathecal setae.

In spite of extensive collecting throughout Burma over a period of more than fifteen years and the examination of many thousands of specimens from all sorts of situations in and around the city of Rangoon the species has not been found in a natural environment and disappeared from the author's flower pots after the second year of collection. In view of these facts and the association in the same pots with the obviously peregrine *bicincta* it is probable that *humilis* is also an importation into Burma.

The description above is based on the first series only, in order to save the second series for future reference.

Diagnosis. Bithecal, spermathecal pores minute and superficial, on 5/6. Male pores minute and superficial, each pore on a circular, disc-shaped porophore. Setae present ventrally on xvi: v/26–29, vi/27–33, xvii/10–12, xviii/6–8, xix/10–12, 40/ii, 47/iii, 54–58/viii, 46–52/xii, 6–12/xvi, 38–44/xx. First dorsal pore on 12/13. Length 20–23 mm. Diameter 2 mm. Segments 75–80.

Septum 8/9 present but membranous. Intestinal caeca simple. Testis sacs annular, seminal vesicles of xi included. Spermathecal duct as long as or longer than ampulla, diverticulum as long as or longer than main axis, with long stalk and three ovoidal seminal chambers separated from each other by short, neck-like regions.

Genus Ramiella Stephenson 1921

Six species are known of which most are inadequately characterized. In fact there is some doubt as to the correctness of including all of these forms in one genus. All species are small, one to two mm. in diameter and therefore especially liable to accidental transportation.

Ramiella cultrifera Stephenson

1931. *Ramiella cultrifera* Stephenson, Rec. Ind. Mus. XXXIII, p. 187. (Type locality Rangoon. Types in the British Museum and Judson College.)

1935. (*Ramiella cultrifera*, Michaelsen, Ann. Mag. Nat. Hist. (10), XV, p. 103. (Christmas Island near Java.)

Material examined. From Burmese collections:

Rangoon, Hanthawaddy district, July, 1 clitellate specimen; August, 1 aclitellate specimen. K. John.

Hmawbi, Insein district, September, 1 aclitellate specimen. K. John.

Toungoo, October, 1 clitellate specimen. K. John.

Mt. Popa, Myingyan district, September, 1 clitellate specimen. K. John.

External characteristics. Length 33–35 mm. Diameter *ca.* 1 mm. The Rangoon worm is only 20 mm. long but may have autotomized a tail portion. Unpigmented. The prostomium is epilobous (tongue not marked off posteriorly — Mt. Popa specimen, tongue pointed posteriorly — Toungoo specimen, normal — Hmawbi specimen).

The clitellum is saddle-shaped, lacking in *aa* (Mt. Popa specimen, condition not determinable on Toungoo specimen as result of damage), from 12/13 to 17/18; intersegmental furrows and dorsal pores lacking.

The spermathecal pores are on viii and ix, on *b*, on the anteriormost margins of the segments just behind the intersegmental furrows. After dissecting the spermathecal ducts out from the parietes a strand of tissue is visible between the aperture and the intersegmental furrow. On one of the types the spermathecal pores are open, the segmental location readily recognizable.

The female pores are paired, slightly anterior and just median to *a*.

The prostatic and male pores are in *ab*, and on the setal arcs of xvii (or just behind), xviii and xix, perhaps a trifle nearer to *b* than *a*, the prostatic pores (common apertures of prostatic ducts and penisetal follicles) usually recognizable without difficulty, the male pores apparently a trifle smaller. The seminal grooves are nearly straight.

Genital markings are tiny, slightly raised tubercles of circular to transversely and shortly elliptical outline, with depressed, greyish translucent central spot: in *ab* just median to the spermathecal pores and at the posterior margin of viii (1 type and the Mt. Popa specimen); on x, in *ab*, between the postsetal secondary furrow and 10/11 (Toungoo specimen); lacking on four types and the aclitellate Hmawbi specimen.

Internal anatomy. Septa 5/6–10/11 are muscular and relative to the size of the animal might be called thickly muscular; 11/12 slightly muscular, opaque.

The gizzard is about twice the width and length of the portion of the gut in the segment next behind, with more or less marked muscular sheen, in vi (Toungoo and Hmawbi specimens). The oesophagus in

ix–xii is slightly moniliform, constricted septally, especially wide in x and xi, with low, irregular, closely crowded ridges placed vertically in xi but longitudinally in x, and larger, smoother, white, longitudinal ridges in xii–xiii. The intestine begins in xiv (4), the oesophageal valve in the anteriormost portion of xiv or reaching into xiii. A slightly irregular and low ridge which may be a rudimentary typhlosole is recognizable in one specimen from xvii posteriorly.

The dorsal blood vessel (single) is continued to the region of the cerebral ganglia. A supra-oesophageal trunk is present in x–xiii. Extra-oesophageal trunks are visible in vii or viii to ix or x, but are empty and unrecognizable anteriorly and posteriorly. Lateroparietal trunks from the region of xiv–xvi pass in xiii to the gut. No subneural. The hearts of xii are bifid (2), one branch passing to the supra-oesophageal trunk, the other to the dorsal vessel. Hearts of xi have been traced to the supra-oesophageal only, of x to the dorsal trunk only. The last pair of hearts is in xii (3).

Nephridia, poorly preserved and easily ruptured are flattened against the parietes in the postclitellar segments; in two longitudinal rows on each side, attached about at *b* and *d*. In one specimen there appears to be an additional row, mesially on each side, of much smaller nephridia. The posteriormost segments are filled with coagulum that is adherent to coelomic walls and segmental organs, removal of the coagulum almost impossible without damage to the excretory tubules, but a slender nephridial duct apparently passes into the parietes near seta *b*. Alongside this duct is a delicate filament (neck?) which can be traced occasionally to and through the septum next in front where it is enlarged into a funnel-like structure close to the ventral parietes. The neck and funnel break off and are lost with such ease that all attempts to remove and mount them for microscopic examination have been unsuccessful.

Male funnels are present in x and xi, both pairs with brilliant spermatozoal iridescence (Toungoo specimen), or the anterior funnels with no iridescence and the posterior funnels slightly iridescent (Mt. Popa specimen). The seminal vesicles are paired in xi and xii (Mt. Popa specimen) or present in xii only (Hmawbi and Toungoo specimens), in the Popa specimen reaching into contact with the dorsal blood vessel. The vas deferens of the Popa specimen is visible as a slightly irregular but strongly iridescent filament on or in the parietes and can be traced back to xviii where it disappears into the parietes midway between the prostatic ducts of a side, in xvii passing lateral to the prostatic ducts. The prostates are slightly flattened, shortly

elliptical in transverse section, looped; the anterior pair reaching into xviii, the posterior pair reaching into xx. The prostatic ducts are short, usually with slight (muscular?) sheen.

Two penisetal follicles, each containing two setae, pass into the parietes on the median face of each prostatic duct in the Popa specimen. Presumably one seta in each follicle is to be regarded as a practically mature, reserve seta. In the Hmawbi and Toungoo specimens there appears to be but a single follicle, each containing two setae, associated with each prostatic duct but the tissues are very delicate and readily separate leaving strands attached to each seta that may represent portions of two distinct follicles. In the Popa specimen both setae of any follicle may be alike or of the two types figured by Stephenson. In the Toungoo specimen the two types of setae are associated with each prostatic duct. The supposed differences between the two types of setae appear to be fictitious and of no importance. Actually each seta is ribbon-like, with the lateral margins along the whole of the shaft, or only a part, rolled into contact. Stephenson's figures 10 and 13 show a complete rolling, while figures 9 and 12 show a rolling of an ectal portion of the shaft. In figure 9 one margin only is rolled while in figure 12b both margins are slightly rolled, the bottom margin more so than the other. Pressure on the setae will usually flatten out most of the rolled portion of a shaft. Three setae mounted in water were flattened out or unrolled merely by the cover glass pressure induced by the evaporation of water while an earlier mount was being examined. The longitudinal line along the shaft towards the right in figure 13 represents the region where the edges or margins come into contact or overlap. This line is usually not to be seen, presumably because it runs along the side of the shaft as the seta lies on the slide but on one seta this line runs along the upper side of the shaft and is visible as a very narrow groove from the base of the tip almost to the ental end. When the ectal ends have been partially unrolled a short region ental to the point where the margins first meet or overlap is quite clearly cylindrical but further entally no trace of a hollow or central cavity is visible and the shaft appears to be solid. Each seta is bent in an arc as shown by Stephenson. A terminal ectal portion about 0.03 mm. long is abruptly narrowed, wrinkled and hooked to one side. This part appears to be solid and cannot be flattened out or unrolled. The ornamentation is of 7–15 short, transverse rows of triangular teeth of variable size, the rows not reaching across the whole of the shaft, and unrecognizable as rows until the shaft is unrolled or flattened. In addition, just behind the tip there may be a few scattered

teeth or irregular rugosities. Measurements in mm. (by Miss Chapman) are given below.

PENIAL SETAE

			Width at base		*Width at midshaft*		
Segment	*Seta*	*Length*	*after unrolling*	*before unrolling*	*after unrolling*	*before unrolling*	*Locality*
xvii	*a*	0.66	0.030	....	....	....	Mt. Popa
xvii	*a*	0.59	0.024	....	....	....	
xvii	*b*	0.50	0.028	0.012	....	....	
xvii	*b*	0.58	0.028	0.014	....	....	
xvii	*a*	0.60	0.020	0.016	....	....	
xvii	*a*	0.61	0.027	0.015	....	....	
xvii	*b*	0.58	0.028	....	....	....	
xvii	*b*	0.52	0.025	....	....	....	
xix	*a*	0.74	0.022	0.014	....	....	
xix	*a*	0.56	0.022	0.015	....	....	
xix	*a*	0.57	0.024	0.019	....	....	
xix	*b*	0.58	0.028	....	....	....	
xix	*b*	0.60	0.022	....	....	....	
xvii	*a*	0.93	0.033	0.024	0.022	0.011	Toungoo
xvii	*b*	0.84	0.034	....	0.027	....	
xix	*a*	0.95	0.032	0.024	0.024	0.013	
xix	*b*	0.82	0.036	....	0.028	....	
...	.	0.95	0.031	0.022	0.030	0.017	Hmawbi
...	.	0.85	0.034	0.024	0.031	0.016	
...	.	0.92	0.032	0.026	0.029	0.016	
...	.	0.83	....	0.027	0.030	0.017	

The ovaries contain a few relatively large ova. In the Toungoo specimen there is a pair of small ovisacs in xiv.

The spermathecal duct is slender, longer than the ampulla, erect and straight, nearly circular in cross section, the lumen narrow and slightly irregular, the wall thick, the epithelium lining the lumen high. The unstalked diverticulum may be borne dorsally at the ental end of the duct with the ampulla hanging ventrally, or the diverticulum and the ampulla may be perpendicular to the end of the duct and on opposite sides, or both diverticulum and ampulla may be pendent on opposite sides from the ental end of the duct. In the aclitellate Hmawbi specimen diverticulum and ampulla are of about the same size, in other words the ampulla larger. Each diverticulum of the clitellate specimens is characterized by a spermatozoal iridescence, the spermatozoa in a long cord which is twisted and looped in a com-

plicated but quite irregular fashion within the diverticulum. In two diverticula the spermatozoal cord passes out of the diverticulum and straight across the duct lumen and down into the ectal portion of the ampulla. The latter is filled with a whitish, non iridescent material.

Remarks. Spermathecal conformations like those shown by Stephenson in fig. 8 or by Michaelsen in fig. 1 have not been found, the ampulla of the Christmas Island worm usually elongated. Nor has any evidence of Michaelsen's seminal chambers been found in the diverticula. The margins of the spermatozoal cord are clearly visible, the coils of the cord apparently filling the whole of a single-chambered diverticulum.

Stephenson found a gizzard in vii in one Rangoon specimen, and a similar location was noted for the Popa specimen but could not be verified after study of later specimens as the worm had been discarded. Michaelsen found the gizzard in vi (the usual location in the genus) in his specimens from Easter Island.

In addition to an apparent intraspecific variation in the segmental location of the gizzard there is variation in the conformation of the prostomium, completeness of the clitellum ventrally, location of the first dorsal pore, setal ratios, presence or absence of ovisacs and the angle of the spermathecal ampulla to the duct. At present these variations do not appear to be of especial importance (the incompleteness of the clitellum mid-ventrally may be due to beginning regression) but most species of the genus are very much alike, distinguished from each other at present rather unsatisfactorily by characteristics of (inadequately described?) penial setae and spermathecae and by the numbers of nephridia.

Diagnosis. Spermathecal pores on *b*, just behind 7/8 and 8/9. Prostatic pores (conjoined openings of prostatic ducts and penisetal follicles) in *ab* at termini of seminal grooves that reach from setal arc of xix to or nearly to the arc of xvii. Male pores in the grooves midway between the prostatic pores. Genital markings (when present) postsetal in *ab*, on viii and x. Clitellum annular, on xiii–xvii. First dorsal pore on 6/7–8/9. Length 20–35 mm. Diameter 1–1.2 mm.

Gizzard in vi. Holandric; seminal vesicles in xii. Spermathecal duct slender and longer than the ampulla; diverticulum spheroidal to ellipsoidal, sessile on ental end of duct. Penial setae ribbon-like, but with lateral edges rolled together along a considerable portion or the whole of the shaft, with a narrowed, hooked, and solid (?) tip; 0.50–0.95 mm. long, 0.012–0.027 thick at base unflattened, 0.022–0.034 flattened, 0.011–0.017 at midshaft unflattened or 0.022–0.031 flattened.

Genus Dichogaster Beddard 1888

Although supposedly preserved in the usual manner much of the Burmese Dichogastrid material has been found to be in unsatisfactory condition perhaps because of maceration due to overcrowding in storage tubes. When worms of such small size are softened internally, determination of external characteristics, at best a rather tedious task, may be more than usually difficult or even impossible. Coelomic cavities are often filled with a sticky coagulum adherent to nephridia, ovaries, etc., and in washing out the coagulum considerable damage may be done to internal structures.

Accordingly a complete account of the internal anatomy of each species is impossible and results of studies of two forms in particular are so unsatisfactory that they have been discarded almost *in toto*.

In species of such small size external characteristics that will enable identification are especially needed. As a result of the study of the material listed below it may be stated that Burmese species at least can be recognized by the female pores (number and location) alone or in connection with certain easily recognized external characteristics. It is perhaps unnecessary to point out that for the present at least, any identification made from external characteristics should be confirmed from examination of internal structures with particular attention to the penial setae.

Dichogaster affinis (Michaelsen)

1890. *Benhamia affinis* Michaelsen, Mitt. Mus. Hamburg, VII, p. 9. (Type locality Quilimane, Zanzibar. Type in the Hamburg Museum.)

Material examined. From Burmese collections:

Bilin, Thaton district, September, 1 clitellate specimen. K. John.

Duyinzeik, Thaton district, September, 1 clitellate specimen. K. John.

Kyaikto, Thaton district, September, 7 clitellate specimens. K. John.

"Jungle", west of Pegu, Pegu district, August, 2 clitellate specimens. K. John.

Thanbula, Thayetmyo district, August, 1 clitellate specimen. K. John.

Magwe, Magwe district, August, 2 clitellate specimens. K. John.

Taungdwingyi, Magwe district, August, 6 clitellate specimens. K. John.

Pyinmana, Yamethin district, October, 5 clitellate specimens. K. John

Mt. Popa, Myingyan district, September, 3 clitellate specimens. K. John.

Dwehla, Kyaukse district, September, 2 clitellate specimens. K. John.

Myotha, Sagaing district, September, 21 clitellate specimens. K. John.

Taungyi and Lashio, F. S. S., August-September, 1 aclitellate and 30 clitellate specimens. H. Young.

Kyaukmyaung, Shwebo district, August, 1 clitellate specimen. Saw San Thwe.

Tiangzup, Myitkyina district, November, 13 clitellate specimens. F. D. Forbes.

External characteristics. Female pores are immediately in front of *a*. Genital markings, unpaired and median, are located as follows: on 8/9, 72 specimens (1 from Kyaukmyaung, 1 from Thanbula, 1 from Bilin, 2 from Dwehla, 1 from Duyinzeik, 4 from Kyaikto, 3 from Pyinmana, 6 from Taungdwingyi, 2 from Pegu, 18 from Myotha, 12 from Tiangzup, 21 from Lashio and Taungyi); on 8/9 and 9/10, 15 specimens (1 from Mt. Popa, 2 from Magwe, 1 from Pyinmana, 3 from Myotha, 7 from Lashio and Taungyi, 1 from Tiangzup); on 9/10, 6 specimens (1 from Mt. Popa, 3 from Kyaikto, 2 from Lashio); on 9/10–10/11, 2 specimens (from Pyinmana and Mt. Popa); on 7/8–9/10, 1 specimen (Lashio).

Dichogaster bolaui (Michaelsen)

1891. *Benhamia bolavi* Michaelsen, Mitt. Mus. Hamburg, VIII, p. 307. (Type locality Bergedorf, Hamburg. Types in the Hamburg Museum.)

Material examined. From Burmese collections:

Sittang, Thaton district, October, 2 clitellate specimens. K. John.

Kyaikto, Thaton district, September, 5 clitellate specimens. K. John.

Prome, Prome district, August, 1 clitellate specimen. K. John.

Toungoo, Toungoo district, October, 10 clitellate specimens. K. John.

Thanbula, Thayetmyo district, August, 1 clitellate specimen. K. John.

Minbu, Minbu district, August, 6 clitellate specimens. K. John.

Taungdwingyi, Magwe district, August, 1 clitellate specimen. K. John.

Pyinmana, Yamethin district, October, 17 clitellate specimens. K. John.

Mt. Popa, Myingyan district, September, 4 clitellate specimens. K. John.

Taungtha, Myingyan district, September, 3 clitellate specimens. K. John.

Dwehla, Kyaukse district, September, 1 clitellate specimen. K. John.

Myotha, Sagaing district, September, 4 clitellate specimens. K. John.

Civil Lines, Mandalay, Mandalay district, October, 3 aclitellate specimens. Miss M. Chapman.

Kyaukmyaung, Shwebo district, August, 1 clitellate specimen. Saw San Thwe.

Katha, Katha district, August, 1 clitellate specimen. Saw San Thwe.

Taungyi and Lashio, F. S. S., August, several clitellate specimens. H. Young.

Wasat Hka, Myitkyina district, November, 1 clitellate specimen. F. D. Forbes.

Tingpai, Myitkyina district, November, 7 clitellate specimens. F. D. Forbes.

External characteristics. The spermathecal pores are on or close to *a*. The single female pore is median.

Dichogaster modiglianii (Rosa) 1896

1896. *Benhamia modiglianii* Rosa, Ann. Mus. Genova, XXXVI, p. 510. (Type locality Padang, Sumatra. Type in the Genoa Museum?)

1931. *Dichogaster modiglianii*, Stephenson, Proc. Zool. Soc. London, 1931, p. 65; Rec. Ind. Mus. Calcutta, XXXIII, p. 198;—*D. doveri* Stephenson, J. Fed. Malay States Mus., XVI, p. 276. (Type locality of *doveri* Kuala Lumpur, Selangor, F. M. S. Types in the British Museum.)

Material examined. From Burmese collections:

Sittang, Thaton district, October, 3 clitellate specimens. K. John.

Kyaikto, Thaton district, September, 1 clitellate specimen. K. John.

Kayan, Hanthawaddy district, September, 2 clitellate specimens. K. John.

Twante, Hanthawaddy district, September, 6 clitellate specimens. K. John.

Rangoon, Hanthawaddy district, January, 4 clitellate specimens. K. John.

Magwe, Magwe district, August, 1 clitellate specimen. K. John.

Toungoo, Toungoo district, October, 1 clitellate specimen. K. John.

Taungdwingyi, Magwe district, August, 3 clitellate specimens. K. John.

Pyinmana, Yamethin district, October, 12 clitellate specimens. K. John.

Mt. Popa, Myingyan district, September, 7 clitellate specimens. K. John.

Hills near Naba, Katha district, September, 8 clitellate specimens. Saw San Thwe.

External characteristics. The prostomium is proepilobous, segment i divided mid-dorsally by a longitudinal groove to 1/2 which is normally developed. Setae begin on ii. The first dorsal pore is probably on 5/6 but on 4/5 of some of the specimens there is a pore-like marking which may be perforate. The clitellum is annular but the epidermal thickening is less developed in *aa* though this is only recognizable in transverse incisions through the body wall.

Spermathecal pores are on or very close to *a*. On each specimen the female pores are on the setal arc or (occasionally) just a trifle behind, and just median to *a*.

Seminal grooves are nearly straight, on or very close to *a*, penial setae protuberant to the exterior from the anterior and posterior ends of the grooves where the prostatic apertures presumably are located. The male pores are represented by dark spots about midway between sites of the prostatic apertures. A longitudinally placed, median and almost rectangular area including the seminal grooves is often slightly whitened but not protuberant.

Internal anatomy. Gizzards are large, always anterior to 8/9 and presumably in vii and viii (13), no septum recognizable between the gizzards. Calciferous glands are in xv-xvii (13). The intestine begins in xix (13), the oesophageal valve in xviii or just reaching into xix (2). The typhlosole which begins more or less abruptly in xxii–xxiii (10) is a high, simple lamella, bent back and forth rather regularly, an anterior portion opaque, the posterior half rather translucent. In worms with 110–120 segments the typhlosole ends rather abruptly in lxxviii–lxxxi (10). In one specimen with only 84 segments the typhlosole ends abruptly in lxviii. In another worm, even shorter, the typhlosole is continued to the hind end of the gut. Just lateral to the median typhlosole, on each side, and in four or five successive segments beginning at xxiii or xxiv there is a lateral typhlosole, a low but quite definite, scarcely lamelliform ridge (13) which is interrupted or very low and scarcely recognizable midsegmentally in each segment.

The dorsal blood vessel (single) is continued anteriorly to the region of the supra-pharyngeal ganglia. The ventral trunk is first recognizable at the anterior margin of the subpharyngeal ganglia. A supra-oesophageal trunk is usually not recognizable and when visible can be seen only in x–xiii. Extra-oesophageal trunks are first visible in the region of the circumpharyngeal nervous commissures from where they run posteriorly in the mass of tissue on and behind the pharynx, receiving several large dorsal branches, with a large transverse connective just anterior to the first gizzard, the trunks well below and lateral to the gizzards, passing onto the ventral face of the gut in ix from whence they gradually approximate to the midventral line until in xii they are actually in contact, unrecognizable posterior to 12/13. In several specimens a parietal vessel in xiv–xix on each side passes up onto the anterior face of 13/14 and apparently into the supra-oesophageal. Anteriorly in xii the extra- and supra-oesophageals are connected by fairly large commissures running around the gut; a smaller pair anteriorly in xi, a still smaller pair on the posterior face of 9/10. The last pair of hearts is in xii (13), the hearts of x–xii bifurcating dorsally, one branch apparently passing into the supra-oesophageal and the other

to the dorsal trunk though it has not been possible to trace both branches of any one heart to connections with the main trunks. All hearts pass into the ventral vessel.

Nephridia, from xx or xxi posteriorly, are fairly large discs flattened against the parietes, at times almost transversely rectangular, in contact or almost so with both septa of a segment, slightly yellowish and with a translucent granular appearance, tubules unrecognizable or recognizable only at the anterior margins of the discs in xx or xxi. These nephridia are in four longitudinal rows on each side, but the medianmost nephridium is quite small, in contact with or actually attached to the nephridium next laterally of which it appears to be a small appendage. From xx or xix to xiii the nephridia have little or no granular investment and are opaque, whitish loops, located in the posterior portions of the segments, just in front of the septa. From xii anteriorly nephridia, in pinned out specimens, are on the anterior faces of the septa.

Septa 10/11 and 11/12 are in contact peripherally to form a testicular chamber that is not opened in carefully dissected specimens. In several worms this chamber, perhaps unusually distended by the testicular coagulum, is herniated anteriorly for some distance along the nerve cord. Beneath the gut in xi is a closed off, transversely placed and median testis sac. In one specimen a herniation from the posterior sac passes forwards into the anterior herniation of the sac of x. Sacs of x and xi are usually filled with coagulum, all male funnels characterized by a brilliant spermatozoal iridescence. Although the worms are sexually functional, seminal vesicles have not been found though tiny whitish structures on the posterior face of 11/12 may represent rudiments of vesicles. Prostates are short and almost straight, slightly flattened, usually confined to xvii and xix, often attached to the anterior faces of 17/18 and 19/20, occasionally penetrating slightly into xviii and xx. The ducts are slenderer than the glands, with slight muscular sheen. Male deferent ducts are easily traced and pass into the parietes in xviii midway between the ectal ends of the prostatic ducts of a side. A column of muscular and connective tissue on the median face of each prostatic duct contains the penial setae. With care it is possible to separate out from this column two follicles (?) each containing one penial seta. In one column, after the supposed follicles containing the functional setae had been removed, two setae were still visible. These are nearly grown reserve setae, one of each type. Close to the base of each reserve seta is a large, ellipsoidal, vesicular nucleus within which a single, spheroidal endosome is visible. The penial setae

are like those of *doveri* Stephenson 1931 but there are usually five to seven teeth visible at each margin of the larger type.

The spermathecal ampulla is shorter than the duct, occasionally much shorter, shortly ellipsoidal and clearly marked off. The duct is slightly bulbous, widened in a middle portion and not especially narrowed in the muscular layers of the body wall, the lumen narrow ectally and with smooth wall, widened in the middle portion, then narrowed again entally though not quite as narrow or with as smooth wall as ectally. The diverticulum comprises a small, spheroidal to shortly ellipsoidal seminal chamber which may be erect or pendent, and a very short and slender stalk that passes into the anterior face of the duct at or just below the region of greatest thickness, opening upwards into the middle chamber of the duct. The seminal chamber is usually characterized by a brilliant iridescence. In a number of spermathecae the middle chamber of the duct is practically filled by a shortly ellipsoidal mass of spermatozoa which is much larger than that of the seminal chamber. In several ampullae there are clumps of rod-like structures that may be crystals or possibly fragments of penial setae. These rods may be transversely segmented.

In xiv there is a pair of small whitish vesicles (13) probably ovisacs.

Remarks. The dorsal and ventral trunks, the extra-oesophageals from 9/10 anteriorly and the hearts are always filled with blood and hence can be easily traced but supra-oesophageals, posterior portions of the extra-oesophageals and other vessels are usually quite unrecognizable in whole or in part. The supra-oesophageal and extra-oesophageal trunk and their connectives are distended with blood so that they can be traced in only two worms. Behind the gizzards 8/9–14/15 are closely crowded but can be identified by the organs between. A satisfactory determination of the gizzard segments and of the anterior septa has not however been made.

The lateral typhlosoles are like the lateral ridges in holandric and primitive metandric species of *Eutyphoeus* but here more extended.

In addition to the material listed above several Burmese specimens identified by Stephenson have been studied. Some of these are labelled *modiglianii*, others *doveri*. All are similar to the worms described above. *D. doveri* was erected for material from the Malay Peninsula but Stephenson later came to the conclusion that *doveri* must be suppressed. There are several mistakes in the account of *doveri*. The last hearts are in xii, not xi, the calciferous glands are in xv–xvii not xiv–xvi, and the intestine begins in xix not xvii. An empty testicular chamber is easily mistaken for a slightly thickened septum and segmental recog-

nition is very difficult if ovaries and nephridia are washed out in freeing the specimen from coelomic coagulum. Septum 18/19 is often pushed anteriorly into contact with 17/18 so that the intestine appears to begin in xviii, the true relationship of the parts ascertainable only with very considerable care in dissection.

Dichogaster saliens (Beddard)

1893. *Microdrilus saliens* Beddard, Proc. Zool. Soc. London, 1892, p. 683. (Types in the British Museum? Type locality undesignated, original specimens from Singapore, Penang and Java.)

Material examined. From Burmese collections:

Toungoo, Toungoo district, October, 1 aclitellate and 4 clitellate specimens. K. John.

Lashio and Taungyi, F. S. S., September, 11 clitellate specimens. H. Young.

Wasat Hka, Myitkyina district, November, 8 clitellate specimens. F. D. Forbes.

Tingpai, Myitkyina district, November, 54 clitellate specimens. F. D. Forbes.

Sumprabum, Myitkyina district, November, 3 clitellate specimens. F. D. Forbes.

"Manure", Mythonkha, Myitkyina district, November, 3 clitellate specimens. F. D. Forbes.

From Malayan collections:

Cameron Highlands, Pahang, F. M. S., 1 aclitellate and 15 clitellate specimens. Raffles Museum.

External characteristics. Length to 68 mm. The diameter of the largest worms in the clitellar region may be as much as 2½ mm. though not more than two mm. elsewhere. Unpigmented. The prostomium is proepilobous but there is a definite furrow at the mid-dorsal line from the apex of the prostomium to or nearly to 1/2 or the site of 1/2. Intersegmental furrow 1/2 is usually almost wholly lacking, unrecognizable until after removal of the cuticle and then only faintly indicated for a short distance on the dorsum near the median line. The first segment accordingly appears to be setigerous but is quite definitely longer than the second setigerous segment (iii) unless the prostomium is deeply retracted.

All setae of ii are present; on xxi *ab ca.* = *cd*, *aa* usually *ca.* = *bc*, but some variation. Ventral setae of xviii are lacking even on aclitellate specimens except as follows: *a* and *b* of left side present (3, from Tingpai), *a* and *b* of right side present (2 from Lashio), *a* of right side

present (1, Tingpai), *b* of left side present (1, Tingpai). When present setae are of the ordinary sigmoid type.

The first dorsal pore is on 4/5 (1), on 5/6 (19, but with a pore-like though apparently imperforate marking on 4/5 of three specimens), on 6/7 (1).

The clitellum is red, usually protuberant, extending from 12/13 onto xix, to 19/20 or onto xx, annular except on xiii, xviii–xx but thinner in *aa*; intersegmental furrows lacking, dorsal pores lacking except on 19/20, setae present.

Spermathecal pores are on 7/8–8/9, on or close to *a*, each pore on a tiny tubercle. Female pores are just median to *a*, on or just behind the setal arc, nearer to *a* than is *b*.

The male genital shield is a transversely placed, almost diamond-shaped area, reaching laterally into *bc*, and possibly slightly onto xvi and xviii (16/17 and 17/18 lacking ventrally), sharply demarcated except in *aa*. On each shield there are two, rather conical protuberances the highest portions of which are about in the region of *ab*, a slight longitudinal groove usually recognizable at the mid-ventral line. Seminal grooves are nearly straight, on the posterior faces of the protuberances, about on *a*, the anterior ends about at the setal arc, the posterior ends approximately at site of 17/18. Male pores, definitely recognized on three specimens only, are at the hind ends of the seminal grooves and hence about on *a*, at or close to site of 17/18. Prostatic pores (usually unrecognizable and always so if penial setae are protuberant to the exterior) are at the anterior ends of the seminal grooves and hence at *a*, on the setal arc. A single penial seta may be protuberant from the anterior end of a seminal groove.

The single genital marking, when present, is on 15/16, in *aa*, with a wide, opaque marginal band and a greyish translucent central area, outline circular or shortly elliptical and then transversely placed. Markings are present on 18 worms; six from Lashio and Taungyi, six from Wasat Hka and six from Tingpai. Of sixteen Malayan worms, six have the marking.

Internal anatomy. Gizzards are anterior to 8/9 and presumably in vii and viii, 7/8 lacking or unrecognizable in dissections. Calciferous glands are one pair, each gland with three more or less reniform lobes in xv–xvii, the size of the lobes increasing from xv posteriorly. The common stalk of the three lobes of a side opens by a very small, slit-like aperture into the gut just lateral to the supra-oesophageal in xv. The intestine begins in xix just behind 18/19 (4). The typhlosole which begins abruptly in xxii (1) or xxiii (3) is a simple lamella, ending

abruptly in lxxxvi (1) or lxxxviii (2, one specimen with 119 segments). Slightly lateral to the median typhlosole, in xxiii–xxix on each side, there is a lateral typhlosole, high intersegmentally, low or interrupted midsegmentally.

The dorsal blood vessel (single) is continued anteriorly onto the pharyngeal bulb. A supra-oesophageal is usually recognizable in xi–xii only. Extra-oesophageals are unrecognizable behind xi, connected by transverse commissures just behind 6/7, anterior to 6/7 continued forwards close to the ventral parietes into ii. No subneural. A latero-parietal vessel is recognizable on each side in xiv–xvii, bifurcating on the anterior face of 13/14, one branch passing to the extra-oesophageal, the other to the supra-oesophageal. The last hearts are in xii (6).

Nephridia in the postclitellar portion of the body are in four longitudinal rows on each side, each nephridium a flattened disc on the parietes in contact with both septa of a segment and with transparent granular investment. The mediannost nephridium on each side decreases in size from just behind the clitellum posteriorly. In the last twenty segments the median nephridium of each side has a small, preseptal funnel.

Seminal vesicles are represented only by small rudiments on the posterior face of 11/12. Prostates are restricted to xvii, the duct with muscular sheen, slightly looped once or twice, three quarters to one mm. long. The vas deferens is widened posteriorly, iridescent, readily visible in xv–xvii where it is looped, in xvii lateral to the prostatic duct and passing into the parietes behind the prostatic ducts.

The spermathecal duct is longer than the ampulla, occasionally only slightly so. The ectal half of the duct has a thick wall and narrow lumen lined with cuticle (?). In the ental half the lumen is widened and more or less irregular. The diverticulum comprises a spheroidal to shortly ellipsoidal seminal chamber and a short, slender stalk passing to the anterior face of the duct.

Penial setae are in two follicles, those of the *b* setae smaller, the *a* setae with more marked sinuosities and slightly thicker. Reserve setae are present in each follicle examined.

The genital marking gland has a definite but thin, capsular wall, the longitudinal musculature thin, transparent over the gland and bulged upwards slightly above the general level of the parietes. A thin greyish spot in the body wall is however all that is visible internally without some dissection among muscle strands.

Remarks. The anteriormost portion of the body is usually softened so that recognition of the first intersegmental furrow, even if present,

would be difficult. The furrow is however clearly undeveloped, except as noted, on several specimens that are almost perfectly preserved.

Family EUDRILIDAE

Genus EUDRILUS E. Perrier

EUDRILUS EUGENIAE (Kinberg)

1867. *Lumbricus eugeniae* Kinberg, Öfv. Ak. Förh. XXIII, p. 98. (Type locality St. Helena. Type in the Stockholm Museum.)

Material examined. From Ceylonese collections:

Heneratgoda, 40 feet, 56 juvenile or aclitellate and 14 clitellate specimens. The Colombo Museum.

From American collections:

Soil, St. Croix, Virgin Islands, 3 aclitellate and 7 clitellate specimens. H. A. Beatty per U. S. Nat. Mus.

External characteristics. Length 90–130 mm. Diameter 6 mm. The dorsum is dark red anteriorly, gradually fading out in the posterior half of the body, but with a pronounced blueish tinge anterior to the clitellum; pigmentation, associated with the circular muscular layer, red. Ventrum unpigmented. The prostomium is epilobous, *ca.* ½, but there is no transverse furrow at the posterior end of the tongue (15). No dorsal pores.

Setae begin on ii on which all four couples are present; on xxiii, *ab*=*cd*, *bc ca.*=½*aa*, *dd*> ½C but only slightly. All setae anteriorly and at the posterior end are sigmoid and ornamented near the tips with short, transversely placed, jagged ridges.

Nephropores begin on iv (25), and are on the anterior margins of the segments, on or just lateral to *c*. Nephropores are unrecognizable on xviii (15 clitellate specimens) or visible but noticeably smaller than on xvii and xix (4 clitellate and several aclitellate specimens).

The clitellum extends from 13/14 to 18/19 and ventrally into a lateral portion of *aa* on each side and is reddish; intersegmental furrows slightly indicated, setae usually present, except the ventral couples of xvii which are always lacking (even on smallest juveniles). The lateral setae of xiv may be lacking (1), or the ventral setae (1), while all setae of xiv–xvii except *a* and *b* on the left side of xvi and the right side of xiv are lacking on one worm. The ventral margin of the clitellum is only marked off externally by a disappearance of the red clitellar color, the epidermis gradually thinned passing ventrally.

The spermathecal apertures are transversely placed, presetal slit

on xiv, of about the same width as *cd*, with centers usually on or just median to *c*, occasionally lateral to *c*, the openings just in front of the setal arc. Margins of apertures are smooth or fairly so even when slightly protuberant.

Apertures of the copulatory chambers are transversely placed, on xvii, just in front of 17/18, with centers on or lateral to *b*, reaching mesially to *a*, the margins slightly protuberant, whitish and finely lobed. The male pore is doubtless minute and was not found, probably on or near the tip of the penis. The latter is four mm. or more in length and gradually thickened dorsally, when completely retracted curved in a crescentic fashion, when protruded nearly straight. The aperture of the Y-gland is a tiny, almost minute slit on a porophore which may be protuberant to the exterior along with the penis. The porophore is much shorter than the penis, with a bluntly rounded ventral end, widened passing dorsally and narrowed again close to the parietes. On the lateral face of the porophore slightly below the ventral end there is a tiny, almost conical protuberance bearing at its tip the vertically placed, slit-like aperture of the Y-gland. From a point just above the pore of the Y-gland a groove runs upwards on the lateral face of the porophore, dorsally turning laterally to pass onto the base of the penis, along the median face of which it is continued to or almost to the ventral end.

Definite genital markings are lacking but on each of segments xvii and xviii of several of the clitellate specimens, in a median portion of *aa*, there is a transversely placed, very slightly protuberant and rather distinctly demarcated area of shortly elliptical outline, reaching anteroposteriorly nearly to the intersegmental furrows. The epidermis of these areas is slightly thickened.

In *cd* or a region reaching slightly median to *c* and on each side there is usually present a longitudinal row of tiny, circular spots. Each of these spots is of about the same size and appearance (under low powers of the binocular) as an open nephropore. With brilliant illumination and high magnification no pore is recognizable but each area is slightly depressed (epidermis thin) and with a brownish appearance. The markings are always postsetal, usually fairly close to the setal arcs, two per segment generally, though an extra marking or even two may be present on any segment and when present not far from the normal markings. Locations of the markings on several specimens selected at random are as follows: i–x (3), i–xi (1), i–xii (3), ii–x (1), ii–xi (1), ii–xii (1), iv–x (1), iv–v (1), extra markings not recorded.

Internal anatomy. All septa from 4/5 posteriorly are present;

4/5–5/6 transparent, 6/7 and several following septa with muscular fibres but thin and translucent.

The gizzard is in v (13). The oesophagus in iv is wide, narrower in vi–xiv, especially so in x–xii. The inner wall of the gut in vi–xiv is provided with low, longitudinally placed, rather irregular, whitish ridges. Unpaired ventral calciferous glands are large, spheroidal to ovoidal, with dark surfaces, stalks very short, slender and straight, to ventral face of gut in median vertical plane. Paired calciferous glands are smaller, always white, anteroposteriorly flattened, in the posterior portion of xii, adherent to the lateral faces of the gut as well as to the anterior face of 12/13. From about the middle of the posterior face of each gland a stalk is continued to the anterior face of 12/13 and into the gut at or just behind the region of septal attachment. Small circular openings into the median glands are readily recognizable but the still smaller openings of the paired glands are harder to find or recognize. Lamellae, in both paired and unpaired pouches, are vertical, in contact centrally in each gland so that the lumen—except just at the stalk region—is reduced to small slit-like spaces. The intestine begins in xiv posteriorly or in xv immediately behind 14/15. In three specimens the valve is in the region of attachment to the gut of 14/15 and is tightly closed, the oesophageal portion of the gut in xiv clearly differentiated from the intestinal portion in xv. In other specimens the valve is relaxed and the portion of the gut in xiv is widened so that determination of the segment of intestinal origin is difficult or impossible. In four specimens septum 14/15 is attached to the gut behind the anterior end of the intestine and cannot be peeled off from this anterior portion. In these worms the intestine appears to begin quite definitely in a posterior portion of xiv. No typhlosole. In a region extending from approximately lxxxv to cxxx there is a longitudinal series of paired, supra-intestinal glands on the dorsal face of the gut, the glands small and in the anterior portions of the segments, in contact with the anterior septa and the dorsal blood vessel (the two glands of a segment separated from each other by the dorsal trunk). Glands are shortly ellipsoidal to almost spheroidal and increase in size slightly passing posteriorly into a middle region, from thence decreasing in size posteriorly. Anteriorly in a few specimens the glands may be flattened and with a triangular dorsal outline, the base and one side along the dorsal blood vessel and the anterior septum. On lifting the gland slowly and carefully from the gut a short and slender, white hollow cord, presumably a duct becomes visible, passing from the ventral side of the gland into the gut wall. On pulling the gland still

further away from the intestine the stalk may break or may come out from the gut wall leaving a tiny circular aperture. Glands are located as follows: lxxxvii–cxxiv (1), xci–cxxii (1), xcii–cxx (1), xci–cxxxii (1), xcv–cxxix (1). Just behind each gland the transverse blood vessel on the dorsal face of the gut may have around it in irregular masses a slightly yellowish material (chloragogen?).

The dorsal blood vessel (single) is continued anteriorly into vii (13) where it usually terminates abruptly with the hearts of that segment. In several specimens a tiny stub projects anteriorly beyond the commissures or a very small vessel continues the trunk onto the dorsal face of the oesophagus from whence it is impossible to trace the vessel anteriorly. A median supra-oesophageal trunk is replaced by a pair of longitudinal vessels on the oesophagus in vii–xii, in contact mesially in the regions of septal attachment (and united?). These vessels are small, usually empty except at or near to junctions with other vessels and adherent to the gut (from which they can be dissected off) and for these reasons are difficult to trace, unrecognizable posterior to 12/13 or anterior to 6/7. The ventral trunk is continued anteriorly to the region of the subpharyngeal ganglia where it bifurcates, the two branches passing laterally. The extra-oesophageal trunk is first recognizable on each side as a fairly large vessel, just behind and parallel to the circumpharyngeal nervous commissures, that passes posteriorly close to the ventral trunk and at about the same level, receiving a large vessel from the parietes in iv and from the anterior face of the septum in v. Just in front of 5/6 or 4/5 there is a transverse connective between the two trunks. In vi the trunks rise to a level above that of the ventral vessel but still below the ventral face of the gut and are continued posteriorly into ix where they usually decrease in size and become empty and unrecognizable. In one specimen the trunks are traceable through x below the median calciferous gland to which branches are given and possibly continued thence into xi to the ventral face of the posterior gland. In one specimen there are clearly visible two longitudinal vessels on the ventral face of the gut in x and xi, apparently with connections anteriorly to the extra-oesophageal trunks. The subneural trunk is large, behind the prostatic region larger than the ventral vessel and looped laterally on both sides of the nerve cord, continued anteriorly to a region in front of the subpharyngeal ganglia. Connectives with the extra-oesophageal or other longitudinal trunks are unrecognizable.

In xiii a large branch from the dorsal trunk passes ventrally on each side along the posterior face of 12/13 just behind the calciferous gland

to which it apparently gives off branches. In xii, just behind 11/12, a similar large branch from the dorsal trunk on each side passes posteroventrally to the anterior margin of the calciferous gland and after giving off a branch which penetrates into an upper portion of the gland passes ventrally along the anterior or anteromedian aspect of the gland. In vii–xi there are large, heart-like commissures, the last hearts always in xi (13). In viii–xi each heart bifurcates dorsally, the posterior branch passing into the dorsal trunk, the anterior bifurcation passing towards the dorsal face of the gut. In x and xi the anterior bifurcation joins a vertical vessel from the dorsal face of the calciferous gland and then opens into a supra-oesophageal or else passes directly into the supra-oesophageal close to the junction of the latter with the vertical vessel from the gland. In ix–viii the anterior bifurcation passes to a supra-oesophageal trunk. Either anterior or posterior bifurcations of the hearts of x–xi may contain blood but in ix–x blood is present only in the posterior bifurcations, the anterior bifurcations slender, white filaments (functional?). Hearts and commissures of vii–xi all pass into the ventral trunk.

Nephridia are on the parietes close to the anterior septum of a segment and extend laterally well towards mid *dd*. Nephrostomes are small, on the anterior faces of the septa close to the ventral parietes and nearer to the nerve cord than to the *a* line. Nephridia are usually present in xviii. In pinned out specimens nephridia of iii-vii, viii or ix are vertically placed on anterior faces of septa rather than transversely on the parietes as posteriorly.

Testis sacs are unpaired, suboesophageal and transversely placed, in the posterior portions of x–xi. From each sac there are protuberant four distinct lobes. Two smaller lobes from the anterior margin pass to the posterior faces of the septa in front and presumably contain the testes. Two protuberances, usually much larger, from the lateral margin reach up more or less conspicuously at the sides of the gut. Male funnels are small, with smooth lips, without spermatozoal iridescence (13) and seated on the ental ends of shortly ellipsoidal bodies which are thin-walled vesicular enlargements of the deferent ducts, the vesicles filled with a closely packed iridescent material. Testicular coagulum extends from the main portion of the sac into the four lobes, surrounding the testes, funnels and vesicles. The ventral blood vessel is adherent to the floor of each testis sac, the hearts entering through the median faces of the lateral protuberances. Seminal vesicles, two pairs in xi and xii, are large — even in aclitellate specimens, soft, folded back on themselves or passing above the dorsal blood vessel into the other side of

their segments. Copulatory chambers are rather bee-hive-shaped and conspicuously protuberant into the coelomic cavity of xvii, often to a height of two mm. or slightly more, occasionally bent over mesially or anteromesially. Prostates are five to eight mm. long and about one mm. thick, the duct muscular but slender, about one mm. long, passing into the center of the dorsal face of the copulatory chamber. Deferent ducts pass lateral to the copulatory chambers and usually into the ectal third of the prostate but in one specimen pass into both prostates at a point midway between the ectal and ental ends. Ental limbs of the Y-gland are adherent to each other, and are slightly unequal in length, the longer about one mm. The duct is slender but muscular, about two mm. long and passes into the median face of the copulatory chamber slightly above the ventral parietes.

Spermathecae are six to eight mm. long, in xiii and xiv. At a point about two mm. or slightly more from the ectal end of each spermatheca there is attached a diverticulum, comprising a spirally wound, muscular stalk three to five mm. long and a soft terminal chamber with an acinous appearance. Sessile on the other side of the duct and about opposite the diverticular junction there is a nearly spheroidal body. Opening into the duct just above the sessile body and on the same side is a slender, thin-walled tube which passes to the posterior face of 12/13 where it turns mesially and is slightly enlarged. The vesicular enlargement which can be dissected off from the septum without especial difficulty contains the ovary. Ental to the diverticulum the spermathecal duct gradually becomes less muscular and eventually is nearly as thin-walled as the ampulla. The latter is about three mm. long, ovoidal to ellipsoidal, fairly sharply marked off from the duct and (in clitellate specimens) filled with a fairly closely packed material in which there is no iridescence.

Abnormalities. One specimen has an extra pair of spermathecal pores on xv, all of the pores just median to *c*. There is an extra pair of spermathecae in xv, the ducts about three mm. long, the left ampulla shrivelled, the right ampulla about one mm. long, vesicular and distended with the same sort of material as in the anterior spermathecae.

Another specimen has a metameric abnormality of the spiral type beginning behind 14/15, a spermathecal pore on the right side only, two male pores on the right side on xix and xxi in addition to a single normal pore on the left side. The left Y-gland is simple, lacking the shorter ental limb. The extra copulatory chamber in xxi is of the usual height but has no prostate, the male deferent duct of the right side opening into the anterior prostate. Associated with the posterior

copulatory chamber is a Y-gland slightly larger than usual and with its duct passing into the center of the dorsal face of the copulatory chamber. Within the chamber is a protuberance just over one mm. long that looks much more like a penis than a Y-gland porophore though of course shorter as well as thicker than a normal penis. There is no groove. The lumen is very small and slit-like.

Regeneration. Three specimens have tail regenerates, two, nine, and twelve mm. long. In one of these worms the tail was lost in the middle of the supra-intestinal gland region. No supra-intestinal glands are recognizable on the gut of the regenerated tail.

Remarks. Characteristics of the testis sacs, here as in other species, are difficult to determine in dissections under water. If the dissection is allowed to dry for a sufficient time and then studied in that condition it is possible to open the sac and remove the testicular coagulum leaving the major portion of the sac wall intact so that the shape can be accurately determined as well as the relationships of the various parts.

One specimen in a late stage of postsexual clitellar regression (as indicated by the discoloration of the clitellar segments) has a large number of brown discs scattered through the coelomic cavities of vi–xxxi; one disc two and a half mm. long, 16 discs about one mm. long, and a much larger number of small discs.

Diagnosis. Apertures of copulatory chambers transverse slits with centers on or lateral to *b* and reaching mesially to *a*, just in front of 17/18. Spermathecal apertures about as wide as *cd*, with centers on or median to *c*. Clitellum saddle-shaped, on xiv–xviii. Setae; *bc* $ca = \frac{1}{2}aa$, $dd > \frac{1}{2}C$, ventral setae lacking on xvii. Nephropores begin on iv, just lateral to *c*. Pigmentation red. Length 90–130 mm. Diameter 6 mm.

Gizzard in v; intestinal origin close to 14/15; supra-intestinal glands in region of lxxxv–cxxx. Last hearts in xi; hearts of viii–xi latero-oesophageal; dorsal blood vessel terminates with commissures of vii. Testis sacs unpaired and ventral, with two small anterior lobes containing testes and two larger laterodorsal lobes containing male funnels and vesicular enlargements of deferent ducts. Copulatory chamber conspicuously protuberant into coelomic cavity and containing a penis about four mm. long and a Y-gland porophore, a groove from the Y-gland aperture passing dorsally along the porophore and then ventrally to tip of penis.

Distribution. "The whole of the tropical zone."

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SCIENTIFIC RESULTS OF A FOURTH EXPEDITION TO FORESTED AREAS IN EAST AND CENTRAL AFRICA

I

MAMMALS

BY GLOVER M. ALLEN AND ARTHUR LOVERIDGE

WITH FIVE PLATES

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No. 1. — *Scientific Results of a Fourth Expedition to Forested Areas in East and Central Africa*

I

Mammals

By Glover M. Allen and Arthur Loveridge

CONTENTS

INTRODUCTION

The collection on which the following report is based, was made by the junior author while investigating the herpetological fauna of certain forested regions in East and Central Africa. The enquiry was carried out on behalf of the Museum of Comparative Zoölogy with a fellowship granted by the John Simon Guggenheim Memorial Foundation of New York.

As in previous reports, the identification and taxonomic work have been done by the senior author whose conclusions appear under the heading *Discussion*. The field notes, contributed by the junior author, are included under: *Breeding, Diet, Parasites, Enemies, Native names, Measurements,* etc.

When measurements are given serially, they are always in the following order: (1) length from snout to anus; (2) length of the tail without terminal hairs; (3) length of hind foot without claws; (4) length of ear from tip to notch. In the case of bats a fifth measurement is added: (5) length of wing from axilla to tip. All dimensions are in millimetres, and, unless otherwise stated, it is those of the *largest* male and *largest* female of the series which are supplied.

The period of collecting mammals was from November 4, 1938, to July 25, 1939, during which time, and exclusive of nearly 200 bat and embryo alcoholics, 612 skins and skulls representing 116 species or races of mammals were secured. Of these, 40 forms were new to the

collections of the Museum of Comparative Zoölogy. A very high percentage of these were topotypes of species described from the Ruwenzori Mountains. As much of this collecting was carried on near the frontiers of Uganda and Tanganyika, it has resulted in the addition of many species to the known fauna of these two countries.

It has been found necessary to describe as new the following subspecies:

Mops angolensis orientis from Kitaya, Tanganyika Territory.
Phataginus tricuspis mabirae from Mabira Forest, Chagwe, Uganda.
Funisciurus pyrrhopus victoriae from Kibale Forest, Toro, Uganda.
Thamnomys venustus kivuensis from Idjwi Island, Belgian Congo.
Leggada bufo ablutus from Idjwi Island, Belgian Congo.

Altitudes, and detailed information regarding the localities in which collecting was carried on, will be published in the final report of this series, but as considerable time is likely to elapse before its publication, a map (see pl. 1) is furnished giving their approximate position. However, many of the forests are of considerable size; Mabira, for example, covers some 120 square miles; so below, in parenthesis, is given the name of the actual camping site — unlikely to be found on any map — and other information likely to be helpful.

Uganda: Budongo Forest (Bisu); Bugoye (E. foothills of Ruwenzori); Bundibugyo (N.W. foot of Ruwenzori); Butiaba (N.E. shore of L. Albert); Fort Portal (Provincial headquarters of Toro); Jinja (N. shore of L. Victoria); Kibale Forest (same as the Mpanga Forest of the Ruwenzori Expedition 1905–6, but Woosnam crossed the Mpanga River about 10 miles north of where Loveridge camped near Isunga); Mabira Forest (Mubango); Mihunga (Loveridge camped on the actual site of the Ruwenzori Expedition's camp, called by them Mubuku Valley, 6000–7000 ft.); Mubuku Valley (Mobuku River on latest Uganda Survey map is admittedly wrong, though map spelling was followed on Loveridge's labels, the other rendering, having appeared in zoological literature, is adhered to here. In this connection it might be pointed out that the type locality of "Ruwenzori East" used by Thomas in his earlier papers, is synonymous with Mubuku Valley between 6000 and 10,000 feet, as will be seen by consulting the final report (1910) in Trans. Zool. Soc. London, **19**). In citing these type localities, therefore, for "Ruwenzori East" we have substituted Mubuku Valley and the precise altitudes, the lowest of which corresponds to Loveridge's 'Mihunga'. Mushongero (Mushungero on labels, but here again, as former spelling has been used in zoological papers by

Pitman, it is followed here. Mushongero is a village on the N.E. shore of L. Mutanda, Kigezi); Nyakabande (a rest camp on the Kabale-Rutschuru road, Kigezi).

TANGANYIKA TERRITORY: Amboni Estate (near Amboni village about 15 miles N. of Tanga); Kitaya (on Rovuma or Ruvuma River, about 20 miles inland); Lake Rutamba (or Lutamba, about 20 miles S.W. of Lindi); Lindi (seaport); Magrotto Mountains (20 miles from Usambara Mountains; camped on Magrotto Estate at edge of forest); Mbanja (10 miles north of Lindi, camped on landing field); Mikindani (on hill 3 miles N. of township); Nchingidi (in forest on Rondo Plateau, about 50 miles S.W. of Lindi); Siga Caves (about 10 miles N. of Tanga, *not* Sigi at foot of Usambara); Tanga (at hotel, before sailing).

KENYA COLONY: Mainland opposite Kilindini ferry (collected near ferry landing).

BELGIAN RUANDA: Kisenyi (N. shore of L. Kivu, camped on roadside at Kiraga 3 miles N. of Kisenyi).

BELGIAN CONGO: Idjwi Island (Kwidjwi, camped on upper reaches of Mulinga River, *circa* 4500 ft.).

A selection of duplicates of such species as were collected in the Belgian Congo and Ruanda, are to be sent to the Congo Museum, Tervueren, in appreciation of the action of His Excellency the Governor of the Congo Belge in granting a permit to collect during the month spent in these countries.

We also take this opportunity of thanking our colleague Dr. Joseph Bequaert for his kindness in identifying the ectoparasites recorded in this paper, Dr. H. R. Hill of Los Angeles Museum for naming linguatulids, also Dr. B. Schwarz and Dr. J. T. Lucker of the United States Department of Agriculture for similar courtesies regarding helminths, and the Rev. Lyndon Harries for eliminating some plural prefixes of native names obtained in southeastern Tanganyika.

For permission to use the blocks of plates 2 and 5, we are indebted to the Editor of the *Scientific Monthly* in which journal (June and July, 1940) they appeared as illustrations to a popular account of the safari.

INDEX TO SPECIES COLLECTED

Systematic Discussion

MACROSCELIDIDAE

Rhynchocyon petersi melanurus Neumann

Rhynchocyon petersi melanurus Neumann, 1900, Zool. Jahrb., Syst., **13**, p. 542: Lindi, Tanganyika Territory.

♂ ♀ (M. C. Z. 38781–2) Nchingidi, T. T. 20. v. 39.

Discussion. Nchingidi, on the Rondo Plateau, lies about fifty miles by road and trail southwest of Lindi. These specimens, therefore, are nearly topotypes, and agree with Neumann's brief diagnosis. The nape and sides are of a rich chestnut, the lower back is much darkened with black. In both, however, may be made out in certain lights the two longitudinal black stripes lying one on each side of the mid-dorsal line, but in one the outer border of each stripe has plainly the series of indentations which in the race *macrurus* partly enclose squarish black spots. The tails have nearly the terminal third white all round, with a small black tip, as mentioned by the describer.

Rhynchocyon petersi macrurus Günther

Rhynchocyon macrurus Günther, 1881, Proc. Zool. Soc. London, p. 163: Rovuma River, 8° S., Tanganyika Territory.

♂ (M. C. Z. 38783) Kitaya, Rovuma River, T. T. 4. iv. 39.

Native names. Litotwe (Kiyao); *norda* (Kimakonde).

Discussion. A single immature specimen from Kitaya may be taken as typical of this elephant-shrew, which is obviously a form of *R. petersi*, and represents more nearly the most primitive condition of the color pattern. The head forward from the crown is a mixture of ochraceous and black; the nape is chestnut with a narrow black median line; the flanks, hips, and belly are chestnut. On the back the pattern of stripes is evident, and unobscured by black. On each side of the midline is a series of squarish chestnut spots, connected on the median side by a slightly darker stripe, the two of opposite sides meeting at the base of the tail. External to this stripe are two more, the upper consisting of some half a dozen alternating chestnut and ochraceous spots, the lower (outer) of smaller and slightly paler spots. The space between the side stripes is a mixed ochraceous and black like the forehead. The pattern thus somewhat resembles that of the checker-backed shrews, but the ground color is chestnut instead of grayish. Evidently the

typical *R. petersi* is a form in which the original checkered pattern is completely obscured by the black back.

Measurements. ♂ juv. 183. 170. 60. 22 mm.

Petrodromus sultani sultani Thomas

Petrodromus sultan Thomas, 1897, Proc. Zool. Soc. London, p. 435: Mombasa, Kenya Colony (misprint of specific name corrected 1898).

♀ (M. C. Z. 38788) Amboni Estate, near Tanga, T. T. 21. vi. 39.

Measurements. ♀. 200. 160. 53. 34 mm.

Diet. Termites only in the stomach so far as could be seen.

Remarks. With my spotlight focussed on its large red eyes, I saw one of these elephant shrews repeatedly kicking its left hind leg on the dry leaves, apparently a nervous action of alarm like the stamping of a rabbit.

Petrodromus rovumae Thomas

Petrodromus rovumae Thomas, 1897, Proc. Zool. Soc. London, p. 434: Rovuma River, 100 miles inland, Tanganyika Territory.

♀ (M. C. Z. 38785) Mbanja, T. T. 6. v. 39.
2 ♂ 1 ♀ (M. C. Z. 38784, 38786–7) Nchingidi, T. T. 16–20. v. 39.

Native name. *Ntotwe* (Kimakonde).

Discussion. The females are much buffier below, as Hollister (1918, p. 29) has noted. A male (M. C. Z. 38784) has a few knobbed bristles on the underside of the tail.

Measurements. ♂. 185. 187. 51. 44 mm., ♀. 160. 161. 52. 38 mm.

Remarks. The Wakonde at Mbanja employed a bag net to capture this giant shrew.

SORICIDAE

Sylvisorex granti granti Thomas

Sylvisorex granti Thomas, 1907, Ann. Mag. Nat. Hist. (7), **19**, p. 118: Mubuku Valley, Ruwenzori Mountains, Uganda, 10,000 ft.

1 ?, 1 ♀, 2 yng. (M. C. Z. 39307–10) Mihunga, U. 28. xii. 38 & 14. i. 39.

Native name. *Mususu* (Lukonjo).

Measurements. ? sex. 66. 52. 11. 7 mm., ♀. 63. 57. 11. 6 mm., young 40. 31. 9. 5 mm.

Breeding. As we were engaged in demolishing the stump of a wild banana, already wrecked by elephant, at the edge of a swamp in the

Mubuku Valley, but at 6,500 feet, the female shrew appeared running round the base of the plant while pulling two young after her. Each of these young was attached by one of the four nipples situated very far back between the hind limbs (14.i.39).

Myosorex blarina Thomas

Myosorex blarina Thomas, 1906, Ann. Mag. Nat. Hist. (7), **18**, p. 139: Mubuku Valley, Ruwenzori Mountains, Uganda, 10,000 ft.

♂ (M. C. Z. 39269) Idjwi Island, B. C. 2. iii. 39.

Native name. *Mushushu* (Lulega).

Discussion. This single skin from an island in Lake Kivu agrees in its blackish color and short tail with Thomas and Wroughton's figure, and is an interesting record for a species hitherto known from the Ruwenzori Mountains.

Measurements. ♂. 67. 40. 14. 9 mm.

Crocidura nyansae kivu Osgood

Crocidura flavescens kivu Osgood, 1910, Ann. Mag. Nat. Hist. (8), **5**, p. 370: Lake Kivu, Belgian Congo.

♀ (M. C. Z. 39198) Bugoye, U. 23. i. 39.

Discussion. This race, slightly smaller and more richly colored than the typical form, has previously been reported from Ruwenzori at altitudes of from 5000 to 7000 feet.

Measurements. ♀. 130. 74. 18. 10 mm.

Remarks. Taken at the rest camp in the Ruwenzori foothills, in a rat trap baited with bread!

Crocidura hirta hirta Peters

Crocidura hirta Peters, 1852, Reise naeh Mossambique, Säugeth., p. 78, pl. xviii, fig. 2: Tette, Mozambique.

1 ♀ (M. C. Z. 38796) Kitaya, Rovuma River, T. T. 28. iii. 39.

5 ♂ 7 ♀ (M. C. Z. 38792–5, –98–801, –819–22) Mikindani, T. T. 11–20. iv. 39.

1 ♂ 1 ♀ (M. C. Z. 38789, 38797) Mbanja, near Lindi, T. T. 27. iv–11. v. 39.

3 ♀ (M. C. Z. 38790–1, 38796) Nchingidi, Rondo, T. T. 17–19. v. 39.

1 ♂ (M. C. Z. 39064) Lindi township, T. T. 1. vi. 39.

Native names. *Chanyunga* (Kimwera); *nanyunga* (Kimakonde at Mikindani); *ntawara* (Kimakonde at Mbanja).

Discussion. In this series from southeastern Tanganyika, the second and third small unicuspids are practically equal in size in both crown area and profile view. The skins show the variations described by Dollman (1915, p. 71): they are grayer in immature animals, but cinnamon or chocolate brown in those with pelage fully grown, variations formerly believed to indicate different species. The lateral gland in both sexes, when adult, is usually marked by a lengthwise spot of appressed hairs.

Measurements. Largest ♂. 110. 64. 15. 11 mm., ♀. 100. 62. 15. 11 mm. Both from Mikindani.

Breeding. On March 28, at Kitaya, an 85 mm. female and her single newborn naked young found lying on damp earth beneath a pile of weeds at the edge of a rice swamp; a surprisingly damp situation but teeming with insect life. On May 1, at Mbanja, a nest containing a single naked nestling. On May 3, another nest held four young, the largest of which measured 55. 13. 10. 5 mm. (alcoholics).

Enemies. One recovered from the stomach of a cobra (*Naja n. nigricollis*) and a young one from a burrowing viper (*Atractaspis bibronii*), both at Mbanja.

Crocidura hirta velutina Thomas

Crocidura velutina Thomas, 1904, Ann. Mag. Nat. Hist. (7), **14**, p. 237: Usambara Mountains, Tanganyika Territory.

11 ♂ 10 ♀ (M. C. Z. 39066–8, 39078–95) Amboni Estate, T. T. 19–21. vi. 39.

♀ (M. C. Z. 39065) Magrotto Mountain, T. T. 1. vii. 39.

Native name. *Keke* (Kisambara).

Discussion. Although Dollman (1915, p. 79) in his review of the genus, gives *C. velutina* the rank of a distinct species, these specimens from northeastern Tanganyika are so closely related to both *C. hirta* and *C. hindei*, there seems no doubt that it is actually but a slightly marked race of the former, with which it agrees in size and color, but differs in that the third upper unicuspid is usually distinctly smaller than the second in side view. We therefore give it doubtful subspecific standing. In one individual (M. C. Z. 39092) it is missing on the left side. Magrotto Mountain is but twenty miles from the type locality, Amboni village about fifty.

Measurements. Largest ♂. 110. 60. 15. 11 mm., ♀. 101. 56. 14. 11 mm. Both from Amboni.

Habitat. The entire Amboni series were living in piles of vegetable debris in a sisal plantation, and were captured when a tractor was engaged in demolishing the piles and spreading them over the ground. The Magrotto shrew was sleeping beneath a bundle of sedges in a swamp.

Crocidura sacralis Peters

Crocidura sacralis Peters, 1852, Reise nach Mossambique, Säugeth., p. 82, pl. xviii, fig. 3: Cabaçeira Peninsula, Mozambique.

1 ♂ 2 ♀ (M. C. Z. 38921–2, 39060) Lindi, T. T. 31. v. 39.

Discussion. The three specimens agree closely with the description of this species originally named from Mozambique. The grayish-cinnamon back, and grayish-white belly are much paler than the coloration of *C. hildegardeae;* the tail is slightly shorter than the head and body; the skull is longer (21 mm.) and the large anterior cusp on the last upper premolar is much reduced so that it is hardly noticeable as a low cingulum.

Measurements. Both ♂ and ♀♀. 75. 40. 14. 5 mm.

Habitat. All taken under bundles of thatching grass in native town.

Crocidura hildegardeae hildegardeae Thomas

Crocidura hildegardeae Thomas, 1904, Ann. Mag. Nat. Hist. (7), **14**, p. 240: Fort Hall, Kenya Colony.

1 ♂ 3 ♀ (M. C. Z. 40739–42) Kisenyi, B. R. 10. ii. 39.
2 ♂ 2 ♀ (M. C. Z. 40735–8) Idjwi Id., B. C. 21. ii & 2–3. iii. 39.

Native name. Mushushu (Lulega).

Discussion. The small size, gray belly, uniformly dark tail, small foot (13 mm. with claws), the skull of 19–20 mm. total length, upper tooth row 8–8.5 mm., distinguish this species, which is widespread in East Africa. In their dull, dark-brown color these specimens agree with others from Kenya Colony and Tanganyika Territory.

Hollister (1918, p. 64) has shown that the various described forms from eastern Africa are possibly unrecognizable as distinct races and that very probably the name *graeilipes* Peters should replace *hildegardeae* of Thomas.

Measurements. Largest ♂. 70. 50. 13. 8 mm., ♀. 80. 49. 13. 8 mm. Both from Idjwi Id.

Breeding. The Kisenyi series, all taken in one nest, evidently consist of a mother (♀. 65. 48. 12. 6 mm.) and her family, of which the male measured 57. 45. 12. 6 mm.

Enemies. One recovered from the stomach of a sedge viper (*Atheris nitschei*).

Crocidura bicolor elgonius Osgood

Crocidura bicolor elgonius Osgood, 1910, Ann. Mag. Nat. Hist. (8), **5**, p. 369: Kirui, Mt. Elgon, Kenya Colony.

♀ (M. C. Z. 39207) Butiaba, U. 5. xii. 38.

Discussion. This specimen is of the same slaty brown as one from Kaimosi, Kenya Colony, and has a skull length of 16 mm.

Measurements. ♀. 65. 46. 9. 7 mm.

Habitat. Under rotting vegetation at the edge of a swamp.

Crocidura bicolor ?hendersoni Dollman

Crocidura bicolor hendersoni Dollman, 1915, Ann. Mag. Nat. Hist. (8), **15**, p. 517: Nyasaland.

1 ♂ 2 ♀ (M. C. Z. 38802–4) Mbanja, T. T. 27. iv. 39.

Native names. Ntawara (Kimakonde at Mbanja).

Discussion. In color these three skins are barely distinguishable from the Butiaba specimen in being less slaty, but distinctly cinnamon brown above, with whitish instead of dusky feet. The skulls measure 17 mm. in length; front of incisor to back of large premolar, 5 mm.; hind foot small, 8 mm. They may represent the race *hendersoni*.

Measurements. ♂. 52. 40. 8. 8 mm., ♀. 58. 35. 8. 8 mm.

Habitat. All taken together, according to the native who brought them in.

Crocidura littoralis Heller

Crocidura littoralis Heller, 1910, Smithsonian Misc. Coll., **56**, No. 15, p. 5: Butiaba, east shore Albert Nyanza, Uganda.

2 ♀ (M. C. Z. 39270–1) Idjwi Id., B. C. 28. ii. & 3. iii. 39.

Native name. Mushushu (Lulega).

Discussion. These two shrews agree with Heller's description in their dark slaty color and faint brownish cast, as well as in having but few scattered bristle hairs on the tail. The skulls agree in their larger size as compared with *niobe* of Ruwenzori, having a total length of 24 mm. in the adult with a tooth row of 10.5 against 20 and 8.2, re-

spectively. This record involves a considerable southward extension of the known range.

Measurements. ♀ ♀ . 88, 82 mm., 65, 61 mm., 17, 15 mm., 10, 5 mm.

PTEROPIDAE

Eidolon helvum helvum (Kerr)

Vespertilio vampyrus helvus Kerr, 1792, Linnaeus's Animal Kingdom, **1**, pt. 1, pp. xvii, 91: No locality.

♀ (M. C. Z. 39197) Mihunga, U. 12. i. 39.

Native names. Kakorokombi (Lukonjo), *chugugu* (Lutoro).

Breeding. Held a large fetus whose head measured 35 mm.

Habitat. Shot from a group of about fifty which we disturbed in a clump of dracaena in the ravine immediately below our camp on Ruwenzori. On returning to the (palms) the others clambered up among the tangle of drooping, withered leaves.

Epomophorus wahlbergi wahlbergi (Sundevall)

Pteropus wahlbergi Sundevall, 1846, Öfversigt af Kongl. Svenska Vet.-Akad. Förhandl., **3**, No. 4, p. 118: Near Fort Natal and in interior of Caffraria.

♀ (M. C. Z. 38840) Mikindani, T. T. 15. iv. 39.

Native names. N'nema (Kimakonde), *nema* (Kimwera).

Measurements. ♀ . 123. 0. 20. 25. 280 mm.

Remarks. Taken in the bat net together with a *Triaenops afer;* the latter was not noticed when at daybreak I transferred the section of the net holding the fruit bat to a cyanide tin. On removing it half an hour later, the fruit bat was found to be dead but much bitten about the breast by the *afer*, which was still alive. It seemed a strange coincidence that in a net of 60 feet by 8 feet the only two bats captured should be taken at the same spot!

Rousettus angolensis (Bocage)

Cynonycteris angolensis Bocage, 1898, Jorn. Sci. Lisboa, (2), **5**, pp. 133, 138, fig.: Pungo Andongo; Cahata; Quibula, Angola.

1 ♂ 8 ♀ (M. C. Z. 38963–71) Magrotto Mtn., T. T. 11. vii. 39.

Native name. Ndema (Kisambara, but not specific).

Discussion. This bat is a member of the subgenus *Lissonycteris.* The short tibia, about 30 mm., short tail, and wing attached to the back of the second toe, readily distinguish this species from *R. leachi.*

The skull length of M. C. Z. 38963 is only 39 mm., or slightly smaller than that given by Andersen (42. 5–44).

Measurements. ♂. 125. 20. 21. 23. 261 mm., ♀. 137. 20. 21. 23. 265 mm.

Parasites. All were swarming with nycteribiids (————————).

Habitat. One was netted at the forest edge, all the rest were taken at the entrance of Kitulwe Cave, higher up the mountain.

EMBALLONURIDAE

Coleura afra (Peters)

Emballonura afra Peters, 1852, Reise nach Mossambique, Säugeth., p. 51, pl. xii, pl. xiii, figs. 18–19: Tette, Mozambique.

5 ♂ 5 ♀ (M. C. Z. 38923,–47–53,–90–91) Siga Caves, T. T. S. vi. 39.
19 ♂ 3 ♀ (alcoholics) Siga Caves near Tanga, T. T. S. vi. 39.

Measurements. ♂. 63. 17. 9. 18. 145 mm., ♀. 64. 18. 9. 16. 150 mm.

Habitat. All netted at the entrance to one of the smaller caves.

Parasites. An arachnid-like dipteron (———————— ————————) on one.

Enemies. One recovered from the stomach of a bat hawk (*Machaerhamphus anderssoni*).

Taphozous mauritianus mauritianus Geoffroy

Taphozous mauritianus E. Geoffroy, 1818, Description de l'Egypte, **2**, p. 127: Mauritius.

1 ♂ 2 ♀ (M. C. Z. 38837–9) Mbanja, T. T. 28. iv. 39.

Native name. *Kiputiputi* (Kimakonde, but not even generic).

Measurements. ♂. 85. 24. 11. 16. 190 mm., ♀. 87. 24. 13. 18. 190 mm.

Parasite. A nycteribiid (———————— ————————).

Habitat. Abundant on coconut palms, living in pairs.

NYCTERIDAE

Nycteris aethiopica oriana Kershaw

Nycteris oriana Kershaw, 1922, Ann. Mag. Nat. Hist. (9), **10**, p. 179: Chiromo, Shire Valley, Nyasaland.

♀ (M. C. Z. 38818) Mbanja, T. T. 27. iv. 39.

Native name. *Kiputiputi* (Kimakonde, but not even generic).

Discussion. This specimen agrees fairly well with the description of this race: tragus crescentic, forearm 51 mm., tibia and extended foot 35 mm., skull length 22 mm. The record involves an eastward extension of the range.

Measurements. ♀. 61. 60. 11. 30. 160 mm.

Nycteris thebaica subsp.

12 ♂ 1 ♀ (M. C. Z. 38805–17) Mbanja, T. T. 4. v. 39.

Discussion. This series includes two full-grown but dark immature individuals. All agree in cranial characters and measurements with *N. thebaica* and possibly represent the race *aurantiaca* de Beaux, described from the Northern Guaso Nyiro, Kenya Colony. They are drabby brown above, and dull grayish below with a clearer ochraceous-tawny tint on the sides of the neck.

Measurements. ♂. 55. 51. 8. 35. 133 mm., ♀. 55. 51. 8. 34. 141 mm.

RHINOLOPHIDAE

Rhinolophus hildebrandtii hildebrandtii Peters

Rhinolophus hildebrandtii Peters, 1878, Monatsb. Akad. Wiss. Berlin, p. 195, pl. i, figs. 1–1a: Ndi, Teita, Kenya Colony.

♂ (M. C. Z. 38823) Mbanja, T. T. 4. v. 39.
♂ (M. C. Z. 38982) Magrotto Mtn., T. T. 11. vii. 39.

Discussion. As pointed out by Hollister (1918, p. 84), the larger size readily distinguishes this species from *R. eloquens* (forearm 56 mm.) which it in general resembles.

Measurements. ♂. 112. 44. 13. 39. 185 mm., from Mbanja.

Habitat. The Mbanja bat, together with the series of *Nycteris thebaica* listed above, was captured by netting the doorway of a small basement room in the ruins of Chief Masudi's father's home on a mangrove-grown estuary.

Rhinolophus fumigatus exsul K. Andersen

Rhinolophus fumigatus exsul K. Andersen, 1905, Ann. Mag. Nat. Hist. (7), **15**, p. 64: Kitui, Kenya Colony.

♂ (M. C. Z. 38824) Mbanja, T. T. 3. v. 39.

Discussion. In the upper jaw the anterior premolar is minute, crowded to the outer side of the tooth row and barely reaching the

cingulum level of the posterior premolar, which is in contact with the canine. In the lower jaw the corresponding tooth is absent. The forearm measures 50 mm.

Measurements. ♂. 58. 26. 9. 24. 150 mm.

Rhinolophus lobatus Peters

Rhinolophus lobatus Peters, 1852, Reise nach Mossambique, Säugeth., p. 41, pl. ix, pl. xiii, figs. 16–17: Sena and Tette, Mozambique.

6 ♂ 4 ♀ (M. C. Z. 38972–81) Magrotto Mtn., T. T. 11. vii. 39.

Native name. *Ndema* (Kisambara).

Discussion. These agree closely with Peters's description and figures, though in their pale-based fur with brown stippling these delicately formed little bats bear at first sight a resemblance to *Hipposideros caffer*. Hollister (1918, p. 84) has recorded the species from Naivasha and Kijabe, Kenya Colony, so that it evidently has a wide range in eastern Africa.

Measurements. ♂. 57. 25. 8. 17. 136 mm., ♀. 59. 24. 8. 17. 137 mm.

Parasite. A large nycteribiid (———— ————) on one.

Habitat. Netted at the entrance to Kitulwe Cave near the summit of the mountain.

HIPPOSIDERIDAE

Hipposideros cyclops (Temminck)

Pyllorrhina cyclops Temminck, 1853, Esquisses Zool. sur la Côte de Guiné, p. 75: Boutry River, Gold Coast.

♀ (M. C. Z. 40829) Budongo Forest, U. 1. xii. 38.

Native name. *Kinyira* (Luganda), usually reserved for fruit bats.

Discussion. The specimen agrees closely with one from Avakubi, Belgian Congo, a topotype of *H. langi*, which Hayman has shown to be synonymous with *H. cyclops*. Its forearm (female) is 71 mm., or slightly larger than that of a male specimen from Liberia (66.5 mm.), but the difference may be merely individual.

Measurements. ♀. 95. 40. 18. 35. 210 mm.

Habitat. Netted in the forestry nursery at Bisu, a clearing in the heart of the forest.

Hipposideros gigas gigas (Wagner)

Rhinolophus gigas Wagner, 1845, Arch. Naturg., **11**, p. 148: Benguela, Angola.

8 ♂ 2 ♀ 1 ? (M. C. Z. 38917–20,–34–40) Siga Caves, Tanga, T. T. 8. vi. 39.

Native name. *Ndema* (Kisambara, but not generic).

Discussion. The discovery of these large bats in northeastern Tanganyika is interesting. Andersen in 1906, when reviewing this group, stated that specimens had been examined from Angola (the type locality) to Gambia (whence he described the race *gambiensis*), but the only evidence of its occurrence on the eastern side of the continent was that afforded by Peters's record (as *Phyllorhina vittata*) from Querimba Islands, Mozambique. Since then, J. A. Allen described in 1917 a new dark race *niangarae*, based on a single female from Niangara, Uele district, northeastern Belgian Congo. The present series secured by Loveridge therefore still further extends the known range. The specimens in measurements fall within the limits given by Andersen, with forearms in males 100–110 mm.; upper tooth row 13.7–14.5 mm.; antorbital width 11–12 mm. In the absence of adequate comparative material, they are regarded as of the typical race.

Measurements. ♂. 140. 43. 25. 35. 323 mm., ♀. 120. 45. 23. 31. 325 mm.

Habitat. The Siga (or Mkulumusi) Caves on the banks of the Mkulumusi River, appear to have been eroded from the limestone by the former course of the river. They are said to extend for a mile; in places the vaulted roof reaches to a great height. Shooting these bats was a most eerie experience; no sooner did we enter than there was a noise as of rushing water, resulting from the wing beats of thousands of bats which had been disturbed by the light from our electric torches. In an outer chamber we came upon the smaller horseshoe bats (*C. afra*), then a huge *Hipposideros* passed me so I followed a narrow passage, from which it seemed to have come, until we came to a high vaulted chamber that was apparently their headquarters. Most of the floor was under water. Squeakings in all sorts of keys seemed to indicate many species, but only *gigas* was revealed by my headlight or fell to my shots. At each report hundreds of bats came whirling about us while clouds of dust, dislodged by the explosion, set us coughing. The floor, carpeted by the accumulated bat guano of centuries, was rendered slippery by the continual dripping of water from the roof. As the bats fell into the pool we recovered them with the aid of a butterfly net. It was interesting to note that on our return to the cave on the following day not a

single giant horseshoe bat was to be seen — they had all migrated to some fresh retreat where they might be free from molestation.

Triaenops afer Peters

Triaenops afer Peters, 1877 (1876), Monatsb. Akad. Wiss. Berlin, p. 913, fig. 2: Mombasa, Kenya Colony.

♂ (M. C. Z. 38836) Mikindani, T. T. 15. iv. 39.
6 ♂ 6 ♀ (M. C. Z. 38941–5,–83–9) Siga Caves, T. T. 8. vi. 39.
19 ♂ 18 ♀ (alcoholics) Siga Caves, near Tanga, T. T. 8. vi. 39.

Native name. *Namutimuti* (Kimakonde and Kimawiha).

Discussion. The short ear with its abruptly narrowed tip is characteristic; forearm 53 mm.; tail extending about two-thirds the distance to the edge of the interfemoral membrane. Most of the skins are a warm golden brown (about Prout's brown of Ridgway) above, somewhat paler below. Two, however, are uniformly bright cinnamon above to cinnamon buff below. Another is evidently molting and retains a collar of 'orange-cinnamon' as well as a small patch of the same in the middle of the back; warm buff below. This bright coloring may mark the fully adult stage. Two immature specimens are darker gray above, whitish below.

Measurements. ♂. 68. 29. 8. 13. 151 mm., ♀. 65. 30. 10. 15. 145 mm.

Remarks. The Mikindani male whose measurements are given above, was netted with *Epomophorus w. wahlbergi* as already related; the Siga series were netted at the entrance of one of the smaller caves.

VESPERTILIONIDAE

Pipistrellus nanus nanus (Peters)

Vespertilio nanus Peters, 1852, Reise nach Mossambique, Säugeth., p. 63, pl. xvi, fig. 2: Inhambane, Mozambique.

4 ♂ 1 ♀ (M. C. Z. 39200, 40808–11) Kibale Forest, U. 19. xii. 38.
2 ♂ 2 ♀ (M. C. Z. 40763–6) Idjwi Id., Lake Kivu, B. C. 4. iii. 39.
6 ♂ 4 ♀ (M. C. Z. 38995–9, 39049–53) Magrotto Mtn., T. T. 29. vi. 39.
10 ♂ 6 ♀ (alcoholic specimens) Magrotto Mtns., T. T. 29. vi. 39.

Native names. *Kihuguhugu*[1] (Lutoro); *belibu* (Luamba); *nundu* (Kisambara).

[1] The Education Department, however, reserves this for fruit bats, and considers *Kahundu* (Lutoro) the correct name for insectivorous bats.

Discussion. This widely distributed little bat is frequently found by day resting inside the rolled-up central frond of the banana plant.

Measurements. ♂. 45. 34. 6. 9. 99 mm., ♀. 45. 42. 6. 9. 104 mm., the ♂ being from Magrotto, the female from Idjwi Id.

Miniopterus minor Peters

Miniopterus minor Peters, 1867 (1866), Monatsb. Akad. Wiss. Berlin, p. 885: Zanzibar coast.

3 ♂ 1 ♀ (M. C. Z. 38946, 38992–4) Siga Caves, Tanga, T. T. 10. vi. 39.

Discussion. These four specimens agree in their dark blackish-gray color above, drabby below, becoming dark smoky gray on the throat and chest. Forearms, 39–42 mm.; skull length, 14 mm. The forearm of the type is said to measure only 37 mm. On the whole, however, these specimens may be best referred to *minor*, of which they are topotypic.

Measurements. ♂. 51. 40. 7. 11. 137 mm., ♀. 47. 43. 8. 10. 138 mm.

Habitat. Netted at the entrance to one of the smaller caves.

MOLOSSIDAE

Mops angolensis orientis subsp. nov.

6 ♂ 4 ♀ (M. C. Z. 38826–35) Kitaya, T. T. 3. iv. 39.

Type. Museum of Comparative Zoölogy No. 38829, an adult male, skin and skull, from Kitaya, Rovuma River, southeastern Tanganyika Territory. Collected by Arthur Loveridge, April 3, 1939.

Description. One of the stout-bodied forms with white underside, slightly smaller than *Mops* (*Allomops*) *angolensis osborni* of the Great Lakes region, to which it is related, and with the upper surface faintly tinged with tawny ochraceous instead of being uniform drabby brown; skull slightly smaller and with less development of the sagittal crest.

Distribution of the fur as in *M. a. osborni*, the wing above naked, but with a narrow line of whitish hairs on the anterior and posterior sides of the humerus; hind legs practically naked as well as the posterior part of the rump and the anal region, where, however, minute scattered hairs are visible under a lens. Face, chin and ears blackish, with minute sparse hairs; toes with the usual longer stiff hairs as well as lateral hairs on outer edge of the first and fifth toes. Entire under surface of the body pure white to the edge of the membrane, with

slight individual variation, so that in some specimens the sides of the neck are pale drab while in others this tint is more extensive, from the axilla back along the side halfway to the groin. Wings dusky brown, becoming whitish lateral to the forearm; this pale area varies individually but may extend to the tip of the third finger.

Measurements. The collector's measurements of the type are: head and body, 86 mm.; tail, 40; hind foot, 13; ear, 19; spread of wings, 340.

The cranial measurements of the skull of the type are: greatest length, 21.8 mm.; condylobasal length, 19.2; palatal length, 9.9; zygomatic width, 13.0; mastoid width, 11.5; width outside molars, 9.5; upper cheek teeth, 7.7.

In the adult-male skull the occiput is produced behind and squarely truncate, with a transverse angular crest, while the knife-like sagittal crest extends forward to the interorbital level. In the upper jaw the anterior premolar is minute and crowded into the outer angle between the canine and large premolar, which are in contact in their median line. In the lower jaw the anterior pair of incisors overlaps the posterior pair, and all four are bifid. In males the two lower premolars are of nearly equal height, but in females the anterior one is distinctly the shorter.

Remarks. The series is uniform in the decided tint of russet above instead of the dull drab of *osborni*, while the much clearer and more extensive white area of the lower side and the whitish wings, distinguish it further and altogether probably reflect the somewhat different climatic conditions of this part of the coast as compared with the Tana River and Lake region. The form, *Mops faradjius*, is a darker representative found in the northeastern Congo forest; probably all should be regarded as races of *M. angolensis*.

Habitat. These bats were roosting under the galvanized roof of the baraza house. I set up the net at 6.30 p.m.; the bats began emerging at 6.45 p.m. and by 7 p.m. I had removed ten of this species and one of the much smaller *C. limbatus*. Naturally their stomachs were empty, none of the females held embryos. The natives apply the same name *kiputiputi* to them as for other small bats.

Chaerephon limbatus (Peters)

Dysopes limbatus Peters, 1852, Reise nach Mossambique, Säugeth., p. 56, pl. xiv: Mozambique Island and Sena, Mozambique.

♀ (M. C. Z. 38825) Kitaya, T. T. 3. iv. 39.

Native name. *Kiputiputi* (Kimakonde); *kaundo* (Kiyao).

Discussion. This female agrees closely with Peters's figures and description. It is difficult to see how *C. hindei* of Thomas, from Fort Hall, Kenya Colony, is really different.

Habitat. Taken together with the larger *Mops* as described above.

Chaerephon pumilus naivashae Hollister

Chaerephon pumilus naivashae Hollister, 1916, Smithsonian Misc. Coll., **66**, No. 1, p. 4: Naivasha Station, Kenya Colony.

1 (alcoholic) Ibis Hotel, Jinja, U. 4. xi. 38.
4 ♂ 5 ♀ (M. C. Z. 39347–55) Budongo Forest, U. 24–26. xi. 38.
2 ♂ 20 ♀ (alcoholic) Bisu, Budongo Forest, U. 26. xi. 38.

Discussion. This series is very uniform in its characters. The color is drab brown above, paler and more drab below; a narrow line of white fur borders the body on the ventral side from axilla to groin and is continued across the upper thigh; membranes dusky, more or less translucent at the sides. In size the series is intermediate between the measurements given by Hollister (1918, p. 98) for this race and the typical form from Eritrea and the Sudan, having the small forearm of the latter (37–39 mm. as against 39–42 mm. in *naivashae*), but with the larger skull of *naivashae* (greatest length 16 mm. or slightly more, against 15 mm. or less as in the Red Sea form). The small upper anterior premolar is well developed and fully in place in the tooth row.

Measurements. ♂. 55. 43. 6. 10. 133 mm., ♀. 60. 37. 7. 16. 140 mm.

Breeding. On November 26, each of the five females examined, held an embryo of which some were well advanced.

Habitat. Very abundant in the buildings of Buchanan's Saw-Mills. At dusk I spread a net between two baulks of timber, and on returning twenty minutes later, found six males and twenty-five females entangled. The entire net was transferred to a cyanide tin, so that later it was possible to disentangle the corpses with comparative ease.

MUSTELIDAE

Poecilogale albinucha doggetti Thomas & Schwann

Poecilogale doggetti Thomas & Schwann, 1904, Abstr. Proc. Zool. Soc. London, No. 6, p. 22: Burumba, Ankole, Uganda.

♂ (M. C. Z. 39357) Mushongero, U. 1. ii. 39.
♂ ♀ (M. C. Z. 39140–1) Kisenyi, B. R. 10. ii. 39.

Native name. Samonyiga (Lugezi).

Discussion. This large race represents the westward extreme of the

species in Central Africa. Lönnberg has recorded specimens from Rutshuru, regarding them as a race of the South African *P. albinucha*, rather than a distinct species. He mentions the discrepancy in size between males and females, but without giving measurements. Of the three specimens secured by Loveridge, an adult male from Mushongero, Lake Mutanda, and an adult female (M. C. Z. 39141) with well-developed sagittal crest, from Kisenyi, Lake Kivu, show the following skull measurements, respectively: greatest length, 59.5, 53.8 mm.; basal length, 55.6, 51.6; palatal length, 27.2, 25.6; zygomatic width, 32.6, 29.5; mastoid width, 29.6, 26.1; width outside upper large premolars, 19.8, 19.0; upper tooth row, 19.0, 17.8; lower tooth row, 19.3, 17.9. The skull of the female appears much smaller and more slender than that of the male, notwithstanding that the actual differences are not very great.

Measurements. ♂. 330. 210. 45. 18 mm., ♀. 325. 130. 39. 16 mm., from Mushongero and Kisenyi respectively.

Aonyx capensis ?hindei (Thomas)

Lutra capensis hindei Thomas, 1905, Ann. Mag. Nat. Hist. (7), **15**, p. 78: Fort Hall, Kenya Colony.

1 (M. C. Z. 39426) Bought at Nyakabande, U. 4. ii. 39.

Discussion. This native-made skin has the head and shoulders hoary, the throat sharply contrasted white as far as a line from lower rim of eye to just below the ear. It is provisionally referred to the race *hindei*, the validity of which may be still open to doubt.

Remarks. Nyakabande, Kigezi district, lies between Lakes Mutanda and Bunyonyi. The skin was one of two bought for $3.25 (the other being in the ethnological collections of the Peabody Museum) in the hopes that it might represent *Paraonyx phillipsi* Hinton, from Lake Bunyonyi. It lacks lips and vibrissae, however, these having been cut away; nor does it exhibit the median head stripe of *phillipsi*. The native from whom it was purchased said that it came from the south end of Lake Mutanda where this larger otter lives in the vast papyrus swamps. All the natives agreed that only two species of otter occur in the lake.

Lutra maculicollis tenuis Pohle

Lutra tenuis Pohle, 1920 (1919), Arch. Naturg., **85**, A, p. 53: Lake Mohasi, Belgian Ruanda-Urundi.

Lutra maculicollis mutandae Hinton, 1921, Ann. Mag. Nat. Hist. (9), **7**, p. 368: Lake Mutanda, British Ruanda, Uganda.

♂ (M. C. Z. 39425) Mushongero, L. Mutanda, U. 31. i. 39.

Native names. *Ngonyi* (Lukiga); *nzibi* (Lulega, for *kivuana*).

Discussion. This handsome skin is dark in color and the throat spots are sharply contrasted white. The postorbital processes as usual are lacking. This specimen is a topotype of *mutandae,* which is almost certainly a synonym of *tenuis,* described a year earlier from a lake lying forty miles further south.

Measurements. ♂. 630. 335. 173. 16 mm.

Diet. A frog (*Xenopus l. bunyoniensis*) was in its stomach. These otters engage in fishing in the early morning and late afternoon, and the one listed here was so engaged when I shot it (from a canoe) in the back of the head.

VIVERRIDAE

Genetta tigrina stuhlmanni Matschie

Genetta stuhlmanni Matschie, 1902, Verh. d. V. Internat. Zool. Congress, Berlin, 1901, p. 1142: Bukoba, Lake Victoria, Tanganyika Territory.

♂ (M. C. Z. 39394) Mabira Forest, U. 9. xi. 38.

Native name. *Kasimba* (Luganda).

Measurements. ♂. 490. 430. 80. 40 mm.

Genetta tigrina suahelica Matschie

Genetta suahelica Matschie, 1902, Verh. d. V. Internat. Zool. Congress, Berlin, 1901, p. 1143: East coast of Tanganyika Territory to Mombasa, Kenya Colony.

♀ (M. C. Z. 38868) Nchingidi, T. T. 11. v. 39.

Discussion. This is a youngish animal from the Rondo Plateau, southwest of Lindi.

Myonax sanguineus proteus (Thomas)

Mungos gracilis proteus Thomas, 1907, Ann. Mag. Nat. Hist. (7), **19**, p. 119: Mubuku Valley, Ruwenzori Mountains, Uganda, 7000 ft.

♀ (M. C. Z. 39272) Mihunga, U. 29. xii. 38.

Native names. *Kasisi* (Lukonjo); [1]*kasindi* (Lutoro).

Discussion. This topotype is an immature individual with blackish limbs and terminal third of tail, but with the head and back finely

[1] Somewhat doubtful as applied also to a squirrel.

sprinkled with ochraceous; the ventral side of the body is dark smoky with very little speckling.

Measurements. ♀. 320. 240. 51. 25 mm.

Parasites. Larval pentastomids (*Armillifer armillatus*) in mesentery.

Atilax paludinosus ?mordax (Thomas)

Mungos paludinosus mordax Thomas, 1912, Ann. Mag. Nat. Hist. (8), **10**, p. 588: Rombashi River, northwest of north end of Lake Nyasa, Tanganyika Territory.

♂ juv. (M. C. Z. 39158) Mushongero, U. 31. i. 39.

Native name. Chihura (Lukiga).

Discussion. This specimen from Lake Mutanda is very young with only the two central pairs of milk incisors in place. It is melanistic with the rather long, lax pelage entirely blackish. The proportionately short tail (90 mm. against head and body length of 220 mm.), the entirely naked soles, and five-toed feet with unwebbed digits, seem sufficient to place it in this genus.

Measurements. ♂ juv. 220. 90. 45. 22 mm.

Bdeogale crassicauda omnivora Heller

Bdeogale crassicauda omnivora Heller, 1913, Smithsonian Misc. Coll., **61**, No. 13, p. 12: Mazeras, Kenya Colony.

♀ (M. C. Z. 39416) Magrotto Mtn., T. T. 12. vii. 39.

Native names. Kicheche or *ngogo* (Kisambara).

Discussion. This adult female is melanistic, nearly black all over, with the sides of the head and body, and to a less extent the back, sprinkled with minute pale tips; the under fur is soiled grayish white, the cylindrical tail deep black. The skull agrees closely in measurements with those published by Hollister (1918, p. 135) for the type and topotype from Mazeras, not far distant in southeastern Kenya Colony.

Measurements. ♀. 450. 220. 78. 38 mm.

Enemies. I came upon a hunting party of four Wasambara and half-a-dozen curs, who had located this mongoose at the end of its burrow between two rocks in the forest. They had already dug out the burrow as far as the rocks would permit and were poking a stick down the hole. Suddenly the mongoose burst from its retreat, was seized by a dog, then rescued by a man who dealt *both* animals a blow with his heavy stick. The men subsequently ate the mongoose!

FELIDAE

Felis brachyura pantasticta Pocock

Felis serralina pantasticta Pocock, 1907, Proc. Zool. Soc. London, p. 665, pl. xxxviii, fig. 3: Entebbe, Uganda.

1 (M. C. Z. 40840) near Mabira Forest, U. xi. 38.

Discussion. This native skin, presented to the Expedition by Mr. J. L. Jarvis, agrees well in color pattern with those from the northeastern Congo as figured by J. A. Allen (1924, pl. xlvii). It comes from a point about sixty miles northeast of the type locality — Entebbe.

LORISIDAE

Galago crassicaudatus lasiotis Peters

Galago lasiotis Peters, 1876, Monatsb. Akad. Wiss. Berlin, p. 912, fig. 1: Mombasa, Kenya Colony.

5 ♂ 1 ♀ (M. C. Z. 39408–12, 39415) Siga Caves, Tanga, T. T. 9–15. vi. 39.

2 ♂ (M. C. Z. 39413–4) Amboni Estate, Tanga, T. T. 20 & 26. vi. 39.

Native name. Komba (Kiswahili and Kisambara).

Discussion. These eight specimens come from localities which, according to Schwarz (1931, p. 45), mark the southern limits of the range of this coastal race. Most of them show a decided tinge of cinnamon on the back; three have white tail-tips; one has the entire terminal half of the tail white; while in another the last third is mixed whitish and dark.

Measurements. ♂. 300. 360. 90. 50 mm., ♀. 280. 360. 90. 48 mm., from Amboni and Siga respectively.

Diet. Apparently acacia gum, in the stomach of one examined.

Parasites. Nematodes (*Subulura* sp. ♀) and encysted larval screwworms (*Armillifer armillatus*).

Habitat. The entire Siga series were shot in one or other of two large acacia trees which they ascended soon after dusk. They could be heard approaching the trees through the dense underbrush, for they were noisily vocal, and would scold at me until the headlight found their glowing eyes. Mr. Tanner, of Amboni Estate, told me that one of these galagos was electrocuted on the 30,000 volt high-tension wires which cross his driveway. The species was heard calling on Magrotto Mountain, but I failed to get any there.

Galago demidovii thomasi Elliot

Plate 3, fig. 1.

Galago (*Hemigalago*) *thomasi* Elliot, 1907, Ann. Mag. Nat. Hist. (7), **20**, p. 189: Fort Beni, Semliki River, Belgian Congo.

♂ (M. C. Z. 38916) Idjwi Island, B. C. 28. ii. 39.

Native name. *Luhololo* (Lulega).

Discussion. This single specimen, which is referred to the race *thomasi*, is dark brown above, and yellowish-washed below. Galagos of this species are especially characteristic of the West African forest area and become rarer on its eastward extension, where their place is taken by the *G. senegalensis* and *G. crassicaudatus* groups, of the gallery and savannah forests.

Measurements. ♂. 150. 200. 53. 25 mm.

Galago senegalensis zanzibaricus Matschie

Galago zanzibaricus Matschie, 1893, Sitzb. Ges. Naturf. Freunde, Berlin, p. 111: Yambiani (*not* Muyuni as given), Zanzibar.

3 ♂ 2 ♀ (M. C. Z. 38911–5) Amboni Estate, T. T. 19–24. vi. 39.

Discussion. According to Schwarz's review (1931, p. 55), specimens from the Tanga district are indistinguishable from those of Zanzibar and the coast region as far south as Dar es Salaam, but inland in the drier country are represented by the race *braccatus*.

Measurements. ♂. 170. 215. 60. 35 mm., ♀. 160. 225. 60. 37 mm.

Habitat. Exceedingly abundant in the preserved patch of secondary forest in the middle of the estate. They were joined by a young *G. s. moholi* which I had brought from Nchingidi a month before, and which escaped from my tent at the forest-edge.

Galago senegalensis moholi A. Smith

Galago moholi A. Smith, 1836, Rep. Exped. Explor. Cent. Africa, p. 42: Banks of the Marikwa and Limpopo, Bechuanaland.

1 ♂ 2 ♀ (M. C. Z. 38875–7) Nchingidi, T. T. 20. v. 39.

Discussion. Although in coloration of the limbs and body closely similar to the series of *zanzibaricus*, these skins from the Rondo Plateau forest have much darker tails with the terminal third blackish, instead of at most the terminal third dusky. Schwarz (1931, p. 57), in his review, includes as of this race specimens from Liwale, Kilwa dis-

trict. One would expect a certain amount of intergradation in this general area.

Breeding. A young one accompanied one of the females.

CERCOPITHECIDAE

CERCOCEBUS ALBIGENA JOHNSTONI (Lydekker)

Semnocebus albigena johnstoni Lydekker, 1900, Novit. Zool., **7**, p. 594: "Near Lake Tanganyika," but probably from the Semliki or Ituri Forest (*fide* Lorenz).

♂ (M. C. Z. 39402) Mabira Forest, U. 12. xi. 38.
3 ♂ (M. C. Z. 39388, 39395–6) Kibale Forest, U. 9–15. xii. 38.

Native name. *Sewagaba* (Luganda).

Measurements. ♂. 630. 840. 175. 40 mm., from Kibale Forest.

Diet. Stomach full of finely masticated green matter.

Habits. The Mabira male was in the company of a troupe of young *C. n. schmidti.* In Kibale forest, on the other hand, where these mangabeys were numerous as well as tame, they went about in large bands of their own kind.

CERCOPITHECUS NICTITANS SCHMIDTI Matschie

Cercopithecus schmidti Matschie, 1892, Zool. Anz., **15**, p. 161: Manyema, west of north end of Lake Tanganyika, Belgian Congo.

♀ (M. C. Z. 39380) Mabira Forest, U. 11. xi. 38.
♂ (M. C. Z. 39374) Budongo Forest, U. 24. xi. 38.
♂ ♀ (M. C. Z. 39379, 39385) Kibale Forest, U. 10 & 13. xii. 38.

Discussion. All four specimens agree closely in color pattern. Those from the Kibale Forest are practically topotypes of *mpangae* Matschie (for the Mpanga River flows through the Kibale Forest) and have been compared with the topotypic series of *kaimosae* Heller from which they do not appear to differ. *C. schmidti mpangae* Matschie, together with its synonyms, is, therefore, referred to the synonymy of *C. n. schmidti* with a distribution from the eastern Belgian Congo across Uganda to western Kenya Colony.

Measurements. ♂. 530. 870. 145. 35 mm., ♀. 495. 615. 120. 30 mm., from Budongo and Mabira Forests respectively. There is considerable variation in tail length.

Diet. A pea-like fruit was present in the stomach of the Budongo male.

Habits. This Budongo male was feeding in the same tree with a solitary female of *C. m. stuhlmanni.* When disturbed, these white-nosed, red-tailed monkeys maintain a continuous bird-like chirping.

Cercopithecus l'hoesti l'hoesti Sclater

Cercopithecus l'hoesti P. L. Sclater, 1899 (1898), Proc. Zool. Soc. London, p. 586, pl. xlviii: Congo.

2 ♀ (M. C. Z. 39382, 39386) Kibale Forest, U. 10 & 13. xii. 38.

Discussion. This handsome, red-backed, black-limbed monkey with contrasting white throat and side whiskers, probably does not extend much to the eastward of this region.

Measurements. Larger ♀. 600. 650. 160. 30 mm. The relatively short tail appears to be a good distinguishing feature.

Parasites. Hair-like nematodes (*Trichuris trichuria*) were present in the stomach.

Cercopithecus mitis stuhlmanni Matschie

Cercopithecus stuhlmanni Matschie, 1893, Sitzb. Ges. Naturf. Freunde Berlin, p. 225: North of Kinyawanga, northwest of Lake Albert, Belgian Congo.

3 ♀ (M. C. Z. 39375, 39377–8) Budongo Forest, U. 24. xi–2. xii. 38.
2 ♂ (M. C. Z. 39398, 39401) Mubuku Valley, U. 2–4. i. 39.
1 ♂ (M. C. Z. 39399) Mihunga, Ruwenzori Mtns., U. 13. ii. 39.

Native names. Nkima (Lukonjo and Lutoro).

Discussion. This is a common species in western Uganda. The three males from Ruwenzori at 7000 feet are practically topotypes of the supposed race *carruthersi,* described from 10,000 feet, now regarded as a synonym.

Measurements. ♂. 630. 800. 160. 40 mm., ♀. 510. 785. 138. 34 mm., from Mubuku and Budongo respectively.

Diet. The stomachs of the Mubuku males were full of berries.

Habits. Both the fine Mubuku males were quite solitary, and the only examples of their species seen during our stay in the valley. One of the Budongo females, however, was associated with a male *C. n. schmidti.*

Cercopithecus mitis schoutedeni Schwarz

Cercopithecus leucampyx schoutedeni Schwarz, 1928, Revue Zool. Bot. Africaine, **16**, p. 126: Idjwi Island, Lake Kivu, Belgian Congo.

2 ♂ (M. C. Z. 38376, 39387) Idjwi Island, B. C. 20–21. ii. 39.

Native name. Nchima (Lulega).

Discussion. These two topotypes amply bear out the characteristics of this race, which has a much paler, slightly buffy back as compared with the darker race *stuhlmanni* farther northward. A similar difference is noticeable in a number of other mammals, in which the races about Lake Kivu are paler than their representatives in the Ruwenzori region.

Measurements. Larger ♂. 600. 860. 172. 36 mm.

Diet. Stomach of one full of pumpkin. In addition to pumpkin, I observed that these monkeys eat maize, millet, and mahoga leaves by raiding gardens adjacent to the forest.

Enemies. If the natives did not encroach upon the forest as they are doing, or cultivate in its immediate vicinity, there might be less plundering. As things are there is much antagonism between them, and the monkeys are very wild through much hunting. On several occasions I heard parties of Bambuti hunting them in the forest to the accompaniment of an infernal din. As, with the exception of the serval, these monkeys are the only large mammal on the island, the natives are eager to eat them.

Cercopithecus mitis monoides Geoffroy

Cercopithecus monoides I. Geoffroy, 1841, Arch. Mus. d'Hist. Nat. Paris (1), **2**, p. 558, pl. xxxi: Lectotype, Rufigi River, 8° S., Tanganyika Territory.

2 ♀ (M. C. Z. 39383–4) Mikindani, T. T. 11 & 14. iv. 39.
♀ (M. C. Z. 39390) Siga Caves, Tanga, T. T. 9. vi. 39.
♀ (M. C. Z. 39389) Magrotto Mtn., T. T. 10. vii. 39.

Native names. Unima (Kimakonde); *lichima* (Kimwera); *ndoue* (Kisambara).

Discussion. This is a somewhat pale coastal form, with pale-orange back, gray hind limbs and under surface; the forearm and thumb are deep black, the hind feet black and gray speckled.

Measurements. ♀. 480. 670. 125. 30 mm. From Magrotto.

Diet. On Amboni Estate I was shown young sisal shoots destroyed by these monkeys. In consequence a bounty of one shilling is paid for each monkey killed.

Remarks. Seen also at Kitaya; and heard at Mbanja, Nchingidi and Amboni where they are shy through much hunting.

Cercopithecus aethiops centralis Neumann

Cercopithecus centralis Neumann, 1900, Zool. Jahrb., Syst., **13**, p. 533: Bukoba, Lake Victoria, Tanganyika Territory.

1 ♂ 2 ♀ (M. C. Z. 39381, 39403, 39418) Mihunga, U. 10 & 17. i. 39.

Native name. *Nkende* (Lukonjo and Lutoro).

Measurements. ♂. 500. 520. 132. 35 mm., ♀. 500. 550. 125. 38 mm.

Breeding. The female was carrying a young ♀. 225. 360. 85. 31 mm., on January 17.

Enemies. The bodies were requested by the Bakonjo, who eat them.

Cercopithecus aethiops johnstoni Pocock

Cercopithecus pygerythrus johnstoni Pocock, 1907, Proc. Zool. Soc. London, p. 638: Moshi, near Kilimanjaro, Tanganyika Territory.

♀ (M. C. Z. 39393) Amboni Estate, near Tanga, T. T. 24. vi. 39.

Native name. *Tumbili* (Kiswahili and Kisambara).

Measurements. ♀. 450. 600. 120. 32 mm.

COLOBIDAE

Colobus polykomos palliatus Peters

Colobus palliatus Peters, 1868, Monatsb. Akad. Wiss. Berlin, p. 637: East Africa, opposite Zanzibar, *i.e.* Pangani River, Tanganyika Territory.

♂ ♀ (M. C. Z. 39391–2) Amboni Estate, near Tanga, T. T. 22. vi. 39.

Native name. *Mbega* (Kiswahili and Kisambara).

Discussion. This is the form of the coastal ranges of northern Tanganyika and southern Kenya Colony.

Measurements. ♂. 570. 730. 167. 31 mm., ♀. 500. 570. 140. 29 mm.

Colobus badius tephrosceles Elliot

Colobus tephrosceles Elliot, 1907, Ann. Mag. Nat. Hist. (7), **20**, p. 195: Ruahara River, Toro, east side Ruwenzori Mountains, Uganda, 4000 ft.

2 ♂ (M. C. Z. 39397, 39400) Kibale Forest, U. 10. xii. 38.

Native name. *Kobi* (Luganda).

Discussion. These examples of *tephroseeles* from Toro must be almost topotypic; although generally rare in collections, Loveridge found it abundant in the Kibale Forest. This race is nearest to *C. b. rufomitratus*, the range of which is now confined to the gallery forests of the lower Tana River.

Measurements. ♂. 600. 720. 160. 31 mm.

Habits. The troupes of red-capped colobus were very large, at least fifty, perhaps double that number, of animals forming a troupe. When fired at they uttered very threatening cries.

MANIDAE

Phataginus tricuspis mabirae subsp. nov.

Plate 3, fig. 2, and Plate 4, figs. 1–2.

Type. Museum of Comparative Zoölogy, No. 39417, an adult male, skin and skull, from Mubango, Mabira Forest, Chagwe, Uganda, collected by Arthur Loveridge, November 12, 1938.

Description. In typical *P. tricuspis* from the Cameroons, the nasals usually show a constriction or waist at the middle then abruptly expand posteriorly and are widest at the point of junction between the maxillae and the anterior corner of the frontals, where the nasals show a sharp angle; in the Uganda skull, however, they are not so narrowed, but expand evenly and gradually with very little trace of an angle, and are produced farther back behind the maxillo-frontal contact. In all four Cameroons skulls examined, the transverse suture formed by the anterior outline of the parietals is farther forward and reaches laterally the angle formed by the anterior root of the squamosal process, whereas in the Uganda skull this line falls well posterior to the squamosal angle (by about 5 mm.). In the latter too, the premaxilla is considerably wider and its ascending process is shorter and much less tapering. In dorsal view there is no interorbital narrowing such as is obvious in the West African skulls, but the outlines are nearly straight and diverging from the anterior tip.

The thin hairy coat on the underside of the body is different in color from any of the eight other specimens from western Africa seen, an 'orange cinnamon' instead of dark blackish brown or gray. The tips of the scales are truncate through wear.

Measurements. The collector's measurements are: head and body, 355 mm.; tail, 555; hind foot, 47. The skull measures: greatest length (which is same as condylo-incisive length), 79 mm.; palatal length, 43.7; mastoid width, 34.3; lacrimal width, 22.0; width at fronto-parietal suture, 29.4; length of mandible, 54.5.

Remarks. In studying the series of *Phataginus* collected by the American Museum's Congo Expedition, Dr. Robert T. Hatt (1934, p. 655) called attention to the wide individual variation in the conformation of the bones of the skull and in other characters, so that the significance of the details of difference mentioned above may to some extent be less than supposed; nevertheless they seem sufficiently striking on the whole to justify the distinction of the extreme eastern

animal of Uganda from that of West Africa, as represented by Cameroons and Ivory Coast specimens.

Native name. *Lugave* (Luganda).

Parasites. Ticks (*Amblyomma cuneatum*) were numerous.

SCIURIDAE

Aethosciurus ruwenzorii ruwenzorii (Schwann)

Sciurus rufobrachiatus ruwenzorii Schwann, 1904, Ann. Mag. Nat. Hist. (7), **13**, p. 71: Wimi Valley, Ruwenzori Mountains, Uganda, 7880 ft.

1 ♂ 2 ♀ (M. C. Z. 39277–9) Mihunga, U. 13–16. i. 39.

Native name. *Kasindi* (Lukonjo and Lutoro).

Discussion. These greenish-olive squirrels with white ventral stripe from chin to anus, from eastern Ruwenzori, are almost topotypic.

Measurements. ♂. 200. 230. 51. 18 mm., ♀. 225. 230. 51. 18 mm.

Breeding. A note to the effect that they were 'not breeding' was made by the collector, but the senior author considers them to be in nursing condition with six mammae — two pectoral and four inguinal.

Heliosciurus rufobrachium arrhenii Lönnberg

Heliosciurus rufobrachiatus arrhenii Lönnberg, Kungl. Svenska Vet.-Akad. Handl., Stockholm (2), **58**, No. 2, p. 68: Masisi, near Kivu, Belgian Congo.

4 ♂ 4 ♀ (M. C. Z. 39097–102, 39138–9) Idjwi Id., B. C. 17–28. ii. 39.

Native name. *Lisbeshi* (Lulega).

Discussion. This series of skins from Lake Kivu shows a slight intensification of the rusty rufous on fore and hind limbs in comparison with those from Uganda referred to the race *nyansae*. The backs are similar in the two, but the long hairs of the tail are mainly black with longer white tips and two or three narrow white, instead of buffy, rings. One individual, however, shows the middle ring ochraceous distally. They are assumed to represent *arrhenii* which probably intergrades with *nyansae* and other neighboring races.

Measurements. ♂. 252. 240. 52. 19 mm., ♀. 245. 190. 55. 20 mm.

Heliosciurus rufobrachium nyansae (Neumann)

Sciurus nyansae Neumann, 1902, Sitzb. Ges. Naturf. Freunde Berlin, p. 56: Kwa Kitoto, Kavirondo, Kenya Colony.

♂ (M. C. Z. 39276) Mabira Forest, U. 15. xi. 38.

2 ♀ (M. C. Z. 39274–5) Budongo Forest, U. 19 & 25. xi. 38.

Native name. *Kakerebwe* (Luganda).
Measurements. ♂. 220. 225. 53. 20 mm., ♀. 220. 250. 50. 16 mm.

Heliosciurus undulatus undulatus (True)

Sciurus undulatus True, 1892, Proc. U. S. Nat. Mus., **15**, p. 465, fig. 3: Mt. Kilimanjaro and Kahe, south of it, Tanganyika Territory.

1 ♂ 1 ♀ (M. C. Z. 39107–8) Siga Caves, near Tanga, T. T. 9. vi. 39.
6 ♂ 9 ♀ (M. C. Z. 39103–6,–9–19) Magrotto Mtn., T. T. 30. vi–15. vii. 39.

Native name. *Nkenda* (Kisambara).

Discussion. The series from Magrotto is referred to the typical race. There is much individual variation in the amount of rusty on the under surface. In a few individuals this region is nearly uniform drabby brown, in others the inner side of the tibiae is bright rufous, less so on the under side of the forearms, while others again show intermediate conditions.

The two from Tanga district agree in being a trifle paler below than the Magrotto series, their throats lacking a distinct rufous tinge, being a pinkish drab instead; while on the sides of the back the pale subterminal ring of the separate hairs is white, instead of ochraceous buff, giving the flanks and dorsum a pale hoary appearance. They do not, however, conform to Thomas's description of his race *daucinus* from Mombasa, as one might have supposed.

Measurements. ♂. 250. 280. 54. 20 mm., ♀. 237. 300. 50. 22 mm. From Magrotto and Siga Caves respectively.

Diet. The Siga pair were feeding in a wild fig. Most of the Magrotto series were shot between 8 and 9 a.m. while eating nuts of the oil palm; one fell dead with a nut in its jaws! Doubtless their abundance on the Estate may be attributed to the rich food supply furnished by the palm plantation. Stomach contents of one consisted solely of these yellow nuts, that of another a white cheesy substance, a third's was mostly green matter.

Parasites. None observed!

Enemies. Eaten by the Wasambara.

Funisciurus pyrrhopus victoriae subsp. nov.

Type. Museum of Comparative Zoölogy, No. 39199, an adult male, skin and skull, from Kibale Forest, Toro, Uganda, collected by Arthur Loveridge, December 16, 1938.

Description. Nearest to *F. p. akka* of northeastern Belgian Congo, its closest neighbor, but differing in having the entire lower surfaces of the body and upper parts of limbs strongly suffused with ochraceous, the hairs at their bases white. In *F. p. akka* the entire under surface is white.

Dorsally, the central region of the body from between the eyes to the base of the tail is a mixture of all-black hairs with those having a narrow subterminal ring of ochraceous buff and a minute black tip; below this area on each side is a narrow stripe of clear ochraceous buff running from shoulder to hip; below this again on the flanks the bases of the hairs become slaty gray with much broader ochraceous rings resulting in a lateral band of clearer ochraceous buff and gray. The upper lips, a spot at the base of the vibrissae extending to the eye ring, clear orange rufous continuing broadly behind the eye to the base of the ear, but darker and duller rufous. Scrotum gray. Tail above, black, many of the hairs white-tipped forming a narrow fringe; under side with the central area dull rufous, bordered by black and narrowly fringed with white. Ears short, with their upper rims and posterior lobe black, edged ventrally with pale ochraceous.

Measurements. The collector's measurements are: head and body, 225 mm.; tail, 160; hind foot, 46; ear, 17. The skull measures: greatest length, 49.0 mm.; basal length, 40.7; palatal length, 24.6; zygomatic width, 25.2; mastoid width, 19.8; width across molars, 11.0; upper cheek teeth, 8.5; lower cheek teeth, 8.5.

Remarks. This is the most eastern of the described races of *F. pyrrhopus*, and though unfortunately based on but a single specimen, nevertheless differs so strikingly in its bright ochraceous under side from its nearest neighbor, *F. p. akka* from Monbuttu, that it seems worthy of a name. According to J. A. Allen's (1922, p. 54) account, *akka* is "exceedingly constant in coloration," his entire series of thirty-two skins having the under parts "pure white to the base of the fur."

Habitat. This little squirrel ran across the new road just cut through the forest southeast of Fort Portal, during a heavy downpour, then paused among the brushwood piled up at the side.

Paraxerus palliatus frerei (Gray)

Macroxus annulatus var. *frerei* Gray, 1873, Ann. Mag. Nat. Hist. (4), **12**, p. 265: Zanzibar.

♂ (M. C. Z. 39096) Siga Caves, T. T. 12. vi. 39.

Discussion. This squirrel, shot at the entrance of the caves near

Tanga, on the mainland almost opposite the type locality, closely matches topotypical material. The name *suahelicus*, formerly used for the mainland animal, is now regarded as a synonym.

Measurements. ♂. 195. 235. 52. 20 mm.

Paraxerus sponsus bridgemani Dollman

Paraxerus bridgemani Dollman, 1914, Ann. Mag. Nat. Hist. (8), **14**, p. 152: Indook, Panda, Mozambique.

2 ♂ 2 ♀ (M. C. Z. 38883, –5–6, –90) Kitaya, T. T. 28. iii–4. iv. 39.
2 ♂ 2 ♀ (M. C. Z. 38884, 38887–9) Mikindani, T. T. 10 & 20. iv. 39.
1 ♂ 1 ♀ (M. C. Z. 38881–2) Nchingidi, Rondo, T. T. 9–12. v. 39.

Native names. Kiruki (Kiyao); *kikubi* (Kimakonde at Kitaya); *chikuvi* (Kimakonde at Mbanja); *chiruma* (Kimwera).

Discussion. In general the series agrees well with the original description, but for a certain amount of individual variation in the amount of orange red in the tail. This may form a lateral border as originally described, or may occur as a mixture with the blackish hairs on both upper and lower sides. In some, with wear, it has disappeared altogether.

Measurements. ♂. 200. 185. 42. 21 mm., ♀. 200. 115. 45. 18 mm., from Kitaya and Nchingidi respectively.

Breeding. On April 3 and 20, half to two-thirds grown young were shot, the smallest, a ♂, measuring 120. 125. 36. 15 mm.

Habitat. At Kitaya two were shot on paths, two in the trees, a Mikindani squirrel in a mango tree. The species is addicted to chattering in the undergrowth very persistently; it is unusually wary, however, about exposing itself.

Paraxerus ochraceus aruscensis (Pagenstecher)

Sciurus cepapi var. *aruscensis* Pagenstecher, 1885, Jahrb. Hamburg. Wiss. Anst., **2**, p. 42: Great Arusha and Pangani River, Tanganyika Territory.

♂ ♀ (M. C. Z. 38908, 38910) Siga Caves, T. T. 9 & 12. vi. 39.
♀ (M. C. Z. 38909) Amboni Estate, Tanga, T. T. 19. vi. 39.

Discussion. The three specimens agree in having the belly broadly buffy, in contrast to typical *ochraceus* of Bagamoyo in which the mixed gray of the sides encroaches on the middle part of the belly.

Measurements. ♂. 175. 130. 39. 18 mm., ♀. 168. 185. 38. 16 mm., from Siga and Amboni respectively.

Habitat. Both Siga squirrels were shot in acacia trees, the Amboni animal was driven out of piled-up rubbish by a tractor.

Paraxerus flavivittis exgeanus Hinton

Paraxerus flavivittis exgeanus Hinton, 1920, Ann. Mag. Nat. Hist. (9), **5**, p. 311: Kilwa Kisiwani, Tanganyika Territory.

8 ♂ 2 ♀ (M. C. Z. 38891–900) Kitaya, T. T. 27. iii–3. iv. 39.
1 ♂ juv. (M. C. Z. 38901) Mbanja, near Lindi, T. T. 1. v. 39.
3 ♂ 2 ♀ (M. C. Z. 38902–6) Nchingidi, T. T. 12–19. v. 39.
1 ♂ (M. C. Z. 38907) Lindi, T. T. 2. vi. 39.

Native names. *Lileje* (Kiyao); *uhindi* (Kimakonde).

Measurements. ♂. 193. 162. 41. 20 mm., ♀. 185. 170. 38. 18 mm., from Kitaya and Nchingidi respectively.

Breeding. At Mikindani, on April 1, a nest, composed of a large loose assemblage of coconut fibre with some admixture of grass, holding a single young one the size of an adult *Mus musculus*, was found in a hollow tree. On being removed from the nest, the young squirrel set up a piercing squeak, so was replaced in the nest in a fork of the tree, while, from afar, we watched to see if the mother would respond to its cries. Presently she did return, but, finding herself observed, fled incontinently down the tree and across a field of short grass towards a big tree fully a hundred yards away. Surprised that fear should dominate maternal affections to such an extent, we returned the nest and its young one to its original hole and left them.

Habits. These squirrels may be seen best an hour after sunrise when they bask in close proximity to their holes, into which they disappear the moment that they realize that they have attracted attention. Their abundance at Kitaya may be attributed to the numerous hardwood trees, full of cavities, which are scattered among the native plots of millet. Thus the squirrel, when plundering the millet, is near a refuge from which it cannot be easily dislodged, the hardness of the wood defying the native axes. The disproportion of the sexes collected at Kitaya, suggests that the females are either more wary than the males, or that litters at this season were monopolizing their attention.

Tamiscus alexandri (Thomas & Wroughton)

Funisciurus alexandri Thomas & Wroughton, 1907, Ann. Mag. Nat. Hist. (7), **19**, p. 376: Gudima, Iri River, Upper Uele, Belgian Congo.

1 ♀ (M. C. Z. 40796) Mabira Forest, U. 11. xi. 38.
4 ♂ (M. C. Z. 39343–6) Budongo Forest, U. 6. xii. 38.

Native name. *Kakerebwe* (Luganda).

Discussion. The white-rimmed ears at once distinguish this striped squirrel. In a series of nineteen specimens from the upper Congo, J. A. Allen (1922, p. 58) found that in "November, December, January, and February specimens the black and white stripes are sharply defined but in April, May and October they are usually much less distinct owing to fading and wear." In the November-December series secured by Loveridge, the black stripe on either side of the dorsal area is clear and distinct with the trace of a shorter dark stripe just below the lateral white line, except in one of the Budongo skins in which the black stripes are much dulled by ochraceous-tipped hairs. Two other skins from near Beni, northeastern Congo, taken December 23 and 28, respectively, have these stripes similarly obscured while a third very young one (taken December 13) has both inner and outer black stripes sharply defined. It seems more likely that instead of being due to "fading and wear," this difference means rather that there are two distinct pelages, roughly corresponding to a summer and a winter pelage, the duller one representing the winter pelage of more northern latitudes. A similar dulling of the stripes is seen in the winter examples of the striped squirrels, *Tamiops*, of Asia. In the first coat of the young these stripes are contrastingly black. That there seems to be considerable irregularity in the season of assumption of the one or the other, probably is due to the fact that the breeding season extends over a considerable period, causing a corresponding lack of uniformity in the time of change from one coat to the other.

Measurements. ♂. 112. 116. 27. 13 mm., ♀. 112. 125. 25. 12 mm.

Habitat. The Budongo series were all shot about 9 a.m. in a large tree in the forestry nursery at Bisu. Rat traps, baited with bread, which had been set about the base of the tree for days previously, failed to attract them.

Tamiscus emini emini (Stuhlmann)

Sciurus emini Stuhlmann, 1894, Mit Emin Pascha ins Herz von Afrika, p. 320: Atyangara, Semliki River, Uganda.

2 ♀ (M. C. Z. 40794–5) Mabira Forest, U. 9 & 12. xi. 38.
2 ♀ (M. C. Z. 40838–9) Kibale Forest, U. 13 & 16. xii. 38.

Native name. Kakerebwe (Luganda).

Discussion. In the series at hand, including the above specimens, there is one from Ruwenzori Mountains, a topotype of *T. vulcanorum lunaris*, in a dull pelage with the first black stripe narrower than the

median buffy area; it is dated January. In the others of the series the black stripes are sharply contrasted and the first, or subdorsal, stripes are broader than the area between them. It seems evident that the dull pelage in this and *T. alexandri* correspond to, and may represent, a 'winter' coat which has now become slightly irregular in the time of its assumption. Possibly also the *T. v. lunaris* is merely this alternative state of *T. emini*.

Breeding. On December 13, a ♀ held a medium-sized embryo (preserved).

Protoxerus stangeri centricola (Thomas)

Sciurus stangeri centricola Thomas, 1906, Ann. Mag. Nat. Hist. (7), **18**, pp. 295, 297: Entebbe, Uganda.

♀ (M. C. Z. 39287) Mabira Forest, U. 18. xi. 38.
1 ♂ 2 ♀ (M. C. Z. 39273, –88, 40791) Budongo Forest, U. 2–3. xii. 38.
♀ (M. C. Z. 39286) Kibale Forest, U. 12. xii. 38.

Native name. Kakerebwe (Luganda).

Discussion. In all but the Kibale specimen the fingers of the hand are uniform black without sprinkling of ochraceous or rufous. The throats are darker grayish than in specimens to the westward.

Measurements. ♂ juv. 200. 220. 52. 17 mm., ♀ . 290. 310. 60. 22 mm., both from Budongo.

Breeding. On December 2, a female was disturbed in the forestry nursery as it ran down a tree. It immediately turned about, fled to the topmost branches, then lay along a branch where it was fairly exposed, but out of gunshot, so I did not fire. As hammering on the trunk did not disturb her, a native was posted to keep watch; half-an-hour later he reported that she had made for the next tree, thence to a third which was still taller. She was restless, however, and kept running to and fro from tree to tree until at last she came within range and was shot. She held two minute embryos (preserved). The following morning as we passed these trees we were scolded by a young male whose head protruded from a knot-hole at a height of sixty feet. Striking a tree with an axe did not silence it, so again a native was posted to summon me when it emerged. When called I found it still scolding and jerking its tail; it turned out to be larger than anticipated, viz. ♂ juv. 200. 220. 52. 17 mm.

MUSCARDINIDAE

Claviglis murinus soleatus (Thomas & Wroughton)

Plate 5, fig. 3.

Graphiurus soleatus Thomas & Wroughton, 1910, Trans. Zool. Soc. London, **19**, p. 499: Mubuku Valley, Ruwenzori Mountains, Uganda, 5000–6000 ft.

♂ ♀ (M. C. Z. 39267–8) Idjwi Id., B. C. 2. iii. 39.

Native name. *Luleka* (Lulega).

Discussion. This adult male and immature female agree closely with the original description. Compared with *C. m. saturatus* of Mt. Elgon, the adult is a darker gray above with only a faint brownish wash, and the under surface is smoke gray as described by Thomas and Wroughton, instead of with whitish-tipped hairs. The immature animal is a uniform dark smoke gray above, slightly paler below, with sharply contrasted white toes. The braincase appears rather flattened instead of vaulted as described for *C. vulcanicus* of Mt. Karisimbi, the description of which otherwise indicates little difference.

Measurements. ♂. 123. 92. 17. 14 mm., ♀. 70. 50. 11. 8 mm.

CRICETIDAE

Tatera cosensi (Kershaw)

Taterona cosensi Kershaw, 1921, Ann. Mag. Nat. Hist. (9), **8**, p. 567: Vihingo, near Ruvu Station, Tanganyika Territory.

1 ♂ 2 ♀ (M. C. Z. 38879–2) Kitaya, T. T. 27. iii. 39.
3 ♂ (M. C. Z. 38843–4, –69) Mbanja, T. T. 27. iv. 39.

Native names. *Lipuku* (Kiyao); *nutu* (Kimakonde at Kitaya); *nkule* (Kimakonde at Mbanja, not even generic).

Discussion. The four adults seem to be referable to this animal, which was described from about forty miles inland from Dar es Salaam. It closely resembles *T. vicina*, of which it should probably stand as a race, somewhat more mixed with blackish on the middle of the back, slightly duller on the sides, and a very little larger in measurements.

Measurements. ♂. 175. 152. 35. 20 mm., ♀. 157. 165. 31. 21 mm., from Mbanja and Kitaya, respectively.

Breeding. On April 27, at Mbanja, two young males measured *circa* 95. 81. 29. 16 mm.

Diet. Adults trapped with bread bait.

Tatera nigrita nigrita Wroughton

Tatera nigrita Wroughton, 1906, Ann. Mag. Nat. Hist. (7), **17**, p. 491: Masindi, Unyoro, Uganda.

♂ ♀ (M. C. Z. 39216–7) Budongo Forest, U. 25. xi. 38.

Discussion. These two gerbils, taken at Bisu about twenty miles west of the type locality, are immature with the last molars not fully erupted. In their blackish backs and ears they contrast sharply in color with the more buffy *T. ruwenzorii*. The claws, though actually pale horn color, appear black with the caked earth in which they must have burrowed.

Tatera ruwenzorii Thomas & Wroughton

Tatera ruwenzorii Thomas & Wroughton, 1910, Trans. Zool. Soc. London, **19**, p. 500: Mokia, s.e. of Ruwenzori Mountains, Uganda, 3400 ft.

♂ (M.C.Z. 40793) Mabira Forest, U. 11. xi. 38.

Native name. Fukuzi (Luganda), usually applied to mole rats!

Discussion. The single specimen agrees closely with the original description in its broad interorbital region, long posterior palatal foramina, color and measurements. Wroughton found it "very numerous on the plains around the south end of Ruwenzori," while this example extends the recorded range slightly to the eastward.

Measurements. ♂. 182. 169. 35. 21 mm.

RHIZOMYIDAE

Tachyoryctes ruandae Lönnberg & Gyldenstolpe

Tachyoryctes ruandae Lönnberg & Gyldenstolpe, 1925, Arkiv Zool., **17**B, No. 5, p. 6: Mt. Muhavura, British Ruanda, Uganda.

4 ♂ 9 ♀ (M. C. Z. 39159, –61–72) Nyakabande, U. 27. i. 39.
1 ? 4 ♂ 7 ♀ (M. C. Z. 39160, –73–81, –95–6) Mushongero, U. 31. i. 39.
1 ♂ 2 ♀ (M. C. Z. 39152–4) Kisenyi, B. R. 9–11. ii. 39.

Native name. Fukuzi (Lukiga).

Discussion. The first two localities listed above lie a few miles to the north of the type locality. Though no mole rats were taken by Loveridge on Idjwi Island in Lake Kivu, the Museum has recently received a specimen from Nyangesi, 27 km. south of Costermansville, and a second from Kanyamundo, which must be very near to the

southwestern limits of the range of this genus. These two rats were collected by Messrs. D. M. Hodgson and W. F. Coultas.

Adults are russet above, the head nearly black, feet dusky, under surface dark slaty gray. The young are uniformly slaty gray with scattered pale-tipped hairs over the posterior part of the back; the russet fur first develops along the flanks and spreads upward toward the middle of the back. Seven of the thirty specimens have a small white area in the middle of the abdomen or lower chest. In *ruandae* the temporal ridges of adults unite in the sagittal line, thus differing from *ankoliae* in which there is said to be always a space of 2–3 mm. between them; however, in an adult female from Kisenyi, on the northeast shore of Lake Kivu, the ridges are well separated, though united in a second specimen from the same locality. The supposed greater size of *ruandae*, as compared with *ankoliae* of southern Uganda, probably does not hold, for while a few of the largest specimens measure in length of head and body, 203, 215, and even 231 mm., most of them are below 200 mm. given for the type of *ankoliae*.

Measurements. ♂. 231. 55. 27. 9 mm., ♀. 210. 73. 30. 29 mm., both from Nyakabande.

Parasites. Fleas (———— ————) were present on a Mushongero rat.

MURIDAE

Dendromus insignis kivu Thomas

Dendromus insignis kivu Thomas, 1916, Ann. Mag. Nat. Hist. (8), **12**, p. 242: Buhamba, Kivu region, Belgian Congo.

7 ♂ 15 ♀ 2 juv. (M. C. Z. 40767–90) Idjwi Id., B. C. 20. ii–3. iii. 39.

Native name. Shungwe (Lulega).

Discussion. Though but slightly marked, this seems to be a valid race with a distinctly narrower dorsal stripe, less broadly expanded over the shoulders than in the typical form, and with the under surface on the average slightly buffier. In size, however, there is probably little, if any, difference when sufficient series are compared. Of the present series, hardly half are adults.

Measurements. ♂. 85. 102. 17. 14 mm., ♀. 87. 95. 20. 13 mm.

Breeding. On February 21, an 82 mm. mother and her four young (of which a ♂ measured 47. 46. 13. 6 mm.) were brought in, the latter squeaking noisily though their eyes were unopened. The following day

an 85 mm. mother and three young (♂. 61. 77. 18. 10 mm., ♀. 62. 82. 18. 10 mm.) arrived, and several other litters on succeeding days.

Enemies. One recovered from the stomach of a snake (*Boaedon l. lineatus*).

Dendromus messorius ruddi Wroughton

Plate 4, fig. 1.

Dendromus ruddi Wroughton, 1910, Ann. Mag. Nat. Hist. (8), **5**, p. 275: Malikisi, Mt. Elgon, Kenya Colony.

5 ♂ 10 ♀ (M. C. Z. 39334–6, –8–42, 40812–8) Bundibugyo, U. 20–24. xii. 38.

1 ♀ (M. C. Z. 39337) Mihunga, Ruwenzori Mtns., U. 14. i. 39.

Native names. Kamampi (Luamba); *kuinji* (Lukonja); *mbeba wa irungu* (Lutoro).

Discussion. This series of sixteen specimens is of uniform appearance, long-tailed and white-bellied, hind foot about 18 mm. They agree so closely in proportions and in the rich tawny color of the back with *D. messorius* of the Cameroons, that there can be no doubt of their close relationship. The latter is slightly more richly colored with an ochraceous wash over the belly. Dr. R. T. Hatt (1940, p. 482), includes specimens from Medje and Niangara, eastern Congo, under typical *messorius*, which therefore ranges quite across the western and central forest area.

Measurements. ♂. 72. 91. 17. 12 mm., ♀. 77. 93. 17. 12 mm.

Breeding. On January 14, at Mihunga, a 65 mm. female was found with her nest, constructed of soft coarse grasses and lined with soft fine grasses and grass heads, measuring about 80 mm. in diameter. It contained three naked, blind nestlings measuring 35. 16. 6. 2.5 mm. The nest and young were subsequently photographed in a domestic banana, in which plant the nests are found most frequently.

On January 23, at Bugoye, eastern foot of Ruwenzori, a native brought in four young with their eyes open. We released these in southwestern Kigezi the following week.

Dendromus whytei pallescens Osgood

Dendromus whytei pallescens Osgood, 1910, Publ. Field Mus. Nat. Hist., Zool. Ser., **10**, p. 7: Lukenya, Ulukenya Hills, Kenya Colony.

♀ (M. C. Z. 38845) Mbanja, T. T. 29. iv. 39.

♀ (M. C. Z. 39059) Magrotto Mtn., T. T. 15. vii. 39.

Native names. Nkule (Kimakonde, but not even generic); *daa* (Kisambara).

Discussion. The Magrotto specimen is slightly paler than typical examples and has a faint indication of a dark dorsal stripe on the rump. The tail is shorter than in *D. m. ruddi:* 77 and 72 mm. respectively in these two females.

Measurements. ♀. 65. 77. 14. 11 mm., from Mbanja.

Breeding. On April 29, this 65 mm. female was brought in with a nest composed of fine grasses and a concealed elastic opening. The structure measured approximately 115 x 65 mm. (4½ x 2½ inches) and held seven naked nestlings. On July 15, a 62 mm. female had only four young, these were furred and their eyes already opened.

Captivity. As Magrotto Mountain, at 3000 feet, was quite a temperate climate, overclouded and with heavy precipitation during much of our stay, I attempted to take the four above-mentioned nestlings back to Europe. In the Red Sea, however, it was very hot—said to be 140° in the sun while we were at Port Sudan—and two of the mice succumbed. The remaining two, after staging brief escapes in the Paris-Bologne and London-Cardiff express, reached Glamorganshire safely. Cold weather apparently affected them but little, for my niece, to whom they were consigned, informs me that they passed the coldest fortnight of the exceptionally severe winter of 1939 in an unheated stone outhouse in Devonshire. However, during a cold spell in December, 1940, they both died one night without any other apparent cause.

In an attempt to tame them, they were handled as much as possible. To do so, however, it was necessary to entice them from their nest. This was resented at times, one used its teeth in protest, and as if seeking freedom from molestation, they built a new nest.

Their roomy cage held several branches, up and down which the active little creatures enjoyed exercising, balancing on the most slender terminal twigs, or hanging upside down from the roof of their cage while they tore off from it splinters of wood.

The food which was furnished them consisted of milk, honey, grapes, bananas, apples, monkey nuts, biscuits, crushed oats, sundry scraps, but principally parrot and canary seed, quantities of which they consumed, though all these foods appeared to be appreciated.

Thamnomys surdaster surdaster Thomas & Wroughton

Thamnomys surdaster Thomas & Wroughton, 1908, Proc. Zool. Soc. London, p. 550: Zomba, Nyasaland.

♂ ♀ (M. C. Z. 39054–5) Magrotto Mtn., T. T. 5. vii. 39.

Native name. *Kozo* (Kisambara).

Discussion. These specimens come from a point within twenty miles of the type locality of *T. usambarae,* apparently a synonym of *surdaster.* It might have been thought that coastal skins would have been identical also with the race *littoralis,* described from Mazeras, Kenya Colony, but the latter have nearly pure white feet, whereas in the Magrotto mice the metatarsal region of the feet is buffy.

Measurements. ♂. 117. 165. 24. 16 mm., ♀. 110. 145. 24. 12 mm.

Enemies. A halfgrown mouse was recovered from the stomach of a snake (*Boaedon l. lineatus*).

Thamnomys surdaster dryas Thomas

Thamnomys dryas Thomas, 1907, Ann. Mag. Nat. Hist. (7), **19**, p. 123: Mubuku Valley, Ruwenzori Mountains, Uganda, 6000–7000 ft.

2 ♀ (M. C. Z. 39202–3) Mihunga, U. 29. xii. 38–16. i. 39.
2 ♂ 1 ♀ (M. C. Z. 39247–9) Idjwi Id., B. C. 20. ii–3. iii. 39.

Native name. *Misisi* (Lulega).

Discussion. The Mihunga specimens are absolute topotypes, those from Lake Kivu, being somewhat immature, are doubtfully identical. They differ from typical *surdaster* in their slightly smaller (21 mm.) hind feet, their backs are a trifle darker, their skulls slightly smaller, which, however, may be due to immaturity, but the hindmost cusp of the last upper molar shows no distinct division into two by a median notch at the hinder end as is the condition in the two typical *surdaster* from Magrotto. As suggested by Dr. R. T. Hatt (1940, p. 539) in the case of one from the same locality, they perhaps represent intermediates between *T. s. dryas* and *T. s. surdaster.* In the former the pectoral pair of mammae is said to be absent, but this may vary individually. Nor is it clear that all are not best considered as races of *T. rutilans* of West Africa.

Measurements. ♀. 123. 142. 22. 16 mm., from Mihunga, Ruwenzori. ♂. 91. 114. 20. 10 mm., ♀. 92. 132. 21. 15 mm., both from Idjwi Id.

Thamnomys venustus venustus Thomas

Thamnomys venustus Thomas, 1907, Ann. Mag. Nat. Hist. (7), **19**, p. 122: Mubuku Valley, Ruwenzori Mountains, Uganda, [1]6000 ft.

♂ (M. C. Z. 39201) Mihunga swamp, U. 18. i. 39.

Discussion. This again is topotypical.

Measurements. ♂. 155. 205. 25. 23 mm.

[1] Given as 6000 ft. in original, 8000 ft. in Trans. Zool. Soc. London, 1919, p. 508.

THAMNOMYS VENUSTUS KIVUENSIS subsp. nov.

Type. Museum of Comparative Zoölogy, No. 39151, an adult female, skin and skull, from Upper Mulinga, Idjwi Island, Lake Kivu, Belgian Congo, collected by Arthur Loveridge, March 2, 1939.

Description. Similar in size, proportions, and tooth characters to typical *venustus* from Ruwenzori, but with the prevailing tint of the dorsal surfaces of the body much duller, warm buff to ochraceous buff instead of 'ochraceous tawny' as in the latter.

Pelage long and silky, hairs of the back about 17 mm. long, slaty in their basal four-fifths, tipped with ochraceous buff and mixed with scattered all-black hairs. Sides of the face and upper part of forearms clearer, more intense ochraceous; flanks paler than back, with few black hairs, the color passing gradually into that of the ventral side, which from chin to anus is dull whitish, faintly washed with buffy at the tips of the hairs, the basal half or so slaty; anal region clearer ochraceous buff. Ears nearly naked, their substance pigmented a dark brown, with scattered short brown hairs externally, ochraceous internally. Fore feet with metacarpal area dark brown, toes whitish; hind feet ochraceous buff, clear, except at the bases of the toes, which are clouded with dusky. Tail much longer than head and body, dark blackish brown all around, the hair of the basal two-thirds short, dark and close, becoming longer in the terminal third to form a thin tuft.

Skull quite like that of *T. venustus,* with the postero-internal cusp of all three upper molars well developed and as large as the two in front of it. Each upper molar, therefore, has three sub-equal elongate cusps on the lingual side, while on the labial side molars 1 and 2 have each four small cusps of which the posteriormost is the smallest.

Measurements. The collector's measurements are: head and body, 145 mm.; tail, 173; hind foot (s. u.), 26; ear, 18. The skull is crushed but shows the following: upper molar row, 6 mm.; diastema, 8.8; width outside first molars, 6.1; breadth of brain case, 13.8; mandible from condyle to tip of incisor, 19.6.

Remarks. The tree rats of this group are difficult to secure; seldom more than one or two occur in even larger collections, while the smaller forms, such as *T. surdaster,* seem commoner or at least easier to trap. Although no others were secured in the Kivu region, the duller, less intense coloring of the single specimen as compared with those from Ruwenzori is paralleled by a similar less-intense coloring in the representative forms of *Dendromus insignis* and *Leggada bufo* of these areas, and hence is probably significant. The Museum of Comparative Zoöl-

ogy has an example of typical *venustus* from Kibati, southeastern base of Mt. Niragongo, Kivu volcanoes, so that its distribution probably extends from Ruwenzori south to this range, while still farther southward beyond these mountains the duller race here described is found.

Habits. At dusk each evening I observed this animal descending a vine in the dense tangle of secondary forest immediately behind my tent. Baiting a snap-back rat trap with a scrap of pawpaw fruit, I set it on the vine at a height of about six feet from the ground and was successful in securing the rat.

Oenomys hypoxanthus unyori (Thomas)

Mus hypoxanthus unyori Thomas, 1903, Ann. Mag. Nat. Hist. (7), **12**, p. 342: [1]Fadjas, on Victoria Nile, Unyoro, Uganda.

♀ (M. C. Z. 39289) Bundibugyo, U. 20. xii. 38.

Native name. *Ndoga* (Luamba); *nsisa* (Lutoro).

Discussion. In this specimen the midventral area is pure white with a buffy line along the lateral border. The distinction between this form and *Oe. h. bacchante*, described from Nandi, Kenya Colony, does not seem well founded, and Hollister doubts if *editus* is really distinguishable from *unyori*.

Measurements. ♀. 140. 180. 27. 19 mm.

Oenomys hypoxanthus editus Thomas & Wroughton

Ocnomys bacchante editus Thomas & Wroughton, 1910, Trans. Zool. Soc. London, **19**, p. 509: Mubuku Valley, Ruwenzori Mountains, Uganda, 6000 ft.

♂ (M. C. Z. 40830) Mihunga, Ruwenzori Mtns., U. 14. i. 39.
♂ (M. C. Z. 39144) Kisenyi, Lake Kivu, B. R. 10. ii. 39.
3 ♀ (M. C. Z. 39142–3, 40744) Idjwi Id., B. C. 20–23. ii. 39.

Native names. *Mbutu* (Lukonjo); *nsisa* (Lutoro).

Discussion. The Lake Kivu specimens agree closely with the topotypical Ruwenzori rat representing the race *editus*, in having the under surface of the body heavily washed with ochraceous, except for the axillae and groins, which are white. In typical *Oe. h. hypoxanthus*, from the Cameroons, the lower surface is tinted faintly, or not at all, with pale ochraceous while the fore part of the body above is more coarsely speckled with the same.

Measurements. ♂. 135. 140. 28. 18 mm., ♀. 170. 200. 33. 21 mm., from Kisenyi and Idjwi, respectively.

[1] Fajao, Murchison Falls, Victoria Nile.

Breeding. On February 23, a 166 mm. female was taken with her three blind nestlings, one of which (M. C. Z. 40744), a ♀, measured 70. 50. 17. 7 mm.

Diet. Two were trapped with bread bait, one by its tail; unfortunately a sixth was destroyed by some other rat eating out its brains as it lay dead in the trap.

Rattus rattus kijabius (Allen)

Mus kijabius J. A. Allen, 1909, Bull. Amer. Mus. Nat. Hist., **26**, p. 169: Kijabe, Kenya Colony.

1 ♂ 1 ♀ (M. C. Z. 39208, 40837) Isungo, near Kibale Forest, U. 14. xii. 38.
1 ♀ (M. C. Z. 39290) Bundibugyo, Bwamba region, U. 20. xii. 38.
1 ♂ 2 ♀ (M. C. Z. 40834–6) Mihunga, Ruwenzori Mtns., U. 4. i. 39.
2 ♀ (M. C. Z. 39209–10) Nyakabande, Kigezi, U. 28. i. 39.
2 ♂ 1 ♀ (M. C. Z. 39155–7) Idjwi Id., Lake Kivu, B. R. 17. ii. 39.
1 ♂ (M. C. Z. 38873) Kitaya, Ruvuma River, T. T. 30. iii. 39.

Seen also at Mushongero, Kisenyi, Ujiji, and Magrotto Mountain.

Native names. Mpanya[1] (Lukonjo and Lutoro); *mbeba* (Lukiga and Lulega); *nkule* (Kimakonde); *likoswe* (Kiyao); *ngoshwe* (Kisambara).

Discussion. This is the common house rat of eastern Africa, abundant in all the native villages, but whether or not it is an introduction from India, or a local race indigenous to this part of Africa, is at present obscure, though the latter alternative seems likely. Immature animals have the entire lower surface slaty gray, often with a faint tinge of buffy; the lower side has more buff-ringed hairs, producing in adults a mixed black and buff effect.

Measurements. ♂. 155. 185. 31. 21 mm., ♀. 180. 213. 32. 23 mm., from Idjwi and Mihunga, respectively.

Diet. Feeding in a mahoga garden at Mihunga.

Enemies. A full-grown rat occupied the entire stomach of an owl (*Bubo a. africanus*) shot at Magrotto. A very large male, measuring 350 (190 + 160) mm., and two half-grown rats, in the stomachs of house snakes (*Boaedon l. lineatus*) at Ujiji, Fort Portal and Magrotto; four very large ones in Gaboon vipers (*Bitis gabonica*) at Budongo and Magrotto, three in nose-horned vipers (*B. nasicornis*) at Mabira and on Idjwi Island. Four furred nestlings in a cobra (*Naja n. nigricollis*) killed in an Indian store at Kitaya.

[1] This is the Kiswahili name for this recent immigrant; the Uganda Education Department informs me that *Nsotima* is more correct for Lukonjo and Lutoro.

Remarks. Woosnam remarked that the Ruwenzori Expedition failed to find this rat on the mountain in 1905–6. Now, in 1939, it is plentiful about the native huts in the Mubuku Valley at 6000 feet, and it remains to be seen what effect it will have on the numerous kinds of smaller rodents occurring in the vicinity.

Aethomys kaiseri hindei (Thomas)

Mus hindei Thomas, 1902, Ann. Mag. Nat. Hist. (7), **9**, p. 219: Machakos, Kenya Colony.

2 ♂ 3 ♀ (M. C. Z. 39056, –132–4, –6) Amboni Estate, T. T. 19. vi. 39.

1 ♂ 6 ♀ (M. C. Z. 39126–31, –5) Magrotto Mountain, T. T. 15–17. vii. 39.

Native name. Sase (Kisambara).

Discussion. On account of its shorter pelage, as compared with *Ae. k. norae* of northern Kenya Colony, the black hairs scattered numerously throughout the dorsal pelage produce less of a lined than a minutely peppered effect. The relatively shorter tails are, as Hollister pointed out, an obvious characteristic. Based on field measurements, the tail averages 83% of the head-and-body length (extremes 71 to 90).

Measurements. ♂. 163. 117. 29. ?20 mm., ♀. 175. 153. 23. 20 mm., both from Magrotto.

Breeding. On June 19, a 155 mm. female, dislodged by a tractor engaged in spreading piles of decaying vegetation, ran from it dragging after her three large young, attached to her nipples. One of these, a ♂, measuring 70. 50. 15. 8 mm., was made into a skin (M. C. Z. 39056), the two others were preserved in alcohol. I had been told previously that for females to carry their young in this fashion was a common practice of rats in this neighbourhood On the peculiar forked tip of the incisors in the young, see Lawrence (1941.)

Enemies. The native youngster who brought me the big series on March 17, was surprised and pleased at my buying the lot, exclaiming: "I have erred in leaving four at my house. Do you want them too?" I replied in the affirmative, provided that they were undamaged. "I will fetch them at once, but it is a long way," said he, departing in haste. Later, he found me frogging in a marsh and proffered his shirt-skirt full of fowl's eggs. "But where are the rats?" I asked. Instead of replying to me in Kiswahili, he spoke rapidly in Kisambara to my local gunbearer, as if uncertain whether it would be good form to tell me the truth! "What does he say?" I enquired. "He says," replied the man,

"that when he got home he found the children had toasted them, skins and all, and eaten them." Lest anyone, with different tastes, should suppose that this reflected poverty, I might add that the picanninies on Magrotto Estate were exceptionally plump through feeding on the oil-palm nuts along with the civets, squirrels, rats, vultures, crows and other creatures.

Praomys jacksoni montis (Thomas & Wroughton)

Mus jacksoni montis Thomas & Wroughton, 1910, Trans. Zool. Soc. London, **19**, p. 503: Mubuku Valley, Ruwenzori Mountains, Uganda, 6000 ft.

2 ♀ (M. C. Z. 39232, 39329) Kibale Forest, U. 10. xii. 38.
1 ♂ (M. C. Z. 40797) Bundibugyo. U. 20. xii. 38.
3 ♂ 1 ♀ (M. C. Z. 39235–6, 39326, 40819) Mubuku V., U. 3–6. i. 39.
2 ♂ 6 ♀ (M. C. Z. 39233–4, –7–8, 39327, –30–32) Mihunga, U. 14–22. i. 39.
4 ♂ 4 ♀ (M. C. Z. 39150, 39240–44, –46, 40734) Idjwi Id., B. C. 24. ii–2. iii. 39.

Native names. *Mbule* (Lukonja); *udiakiru* (Lutoro); *sisisi* (Lulega).

Discussion. The series from Idjwi Island seems identical with the topotypes from Ruwenzori. One large 135 mm. (head and body) female has a skull with condylobasal length of 30.5 mm. The tipping of the dorsal hairs in adults is pale ochraceous instead of the brighter cinnamon of typical *jacksoni*. Two from Kibale forest are in the bright cinnamon pelage, rather brighter in tint than M.C.Z. 39232, the only one of the Ruwenzori series in this phase.

Measurements. ♂. 160. 172. 30. 18 mm., ♀. 135. 160. 26. 17 mm., from Mihunga and Idjwi, respectively.

Diet. Trapped with cheese.

Breeding. On February 24, the large female, mentioned above, was brought in together with two, still blind, nestling males measuring 68. 62. 17. 9 mm.

Enemies. Six two-thirds grown young in the stomach of a mamba (*Dendroaspis j. kaimosae*).

Praomys taitae (Heller)

Epimys taitae Heller, 1912, Smithsonian Misc. Coll., **59**, No. 16, p. 9: Mt. Mbololo, Teita Hills, Kenya Colony, 5000 feet.

♂ (M. C. Z. 39057) Magrotto Mtn., T. T. 11. vii. 39.

Native name. *Hunju* (Kisambara).

Discussion. Compared with topotypes obtained by Loveridge in 1934. It is interesting to note that the present specimen was obtained under closely similar habitat conditions.

Measurements. ♂. 102. 111. 23. 18 mm.

Habitat. Noticing a burrow between the buttress roots of a huge tree in the heart of the forest, I ordered the gunbearers to dig. At eighteen inches or thereabouts below the surface the burrow, which had sloped steeply downwards to this point, turned upwards and divided into two short passages. One held a loose assemblage of dry leaves in a fragmentary state in which this rat was hiding, the other was a blind passage.

HYLOMYSCUS DENNIAE DENNIAE (Thomas)

Mus denniae Thomas, 1906, Ann. Mag. Nat. Hist. (7), **18**, p. 144: Mubuku Valley, Ruwenzori Mountains, Uganda, 7000 feet.

♂ (M. C. Z. 39328) Mubuku Valley, U. 6. i. 39.

Discussion. This single topotype, also taken at 7000 feet, was the only one obtained by Loveridge during his week at Mubuku camp, though R. B. Woosnam found it "extremely common" at the same spot in 1906.

HYLOMYSCUS CARILLUS SCHOUTEDENI (Dollman)

Epimys schoutedeni Dollman, 1914, Revue Zool. Africaine, **4**, p. 82: Mambaka, Belgian Congo.

2 ♀ (M. C. Z. 39239, 39245) Idjwi Id., B. C. 25. ii. 39.

Native name. Mtumhabuva (Lulega).

Discussion. An adult female and its two-thirds grown young are referred to the form *schoutedeni*, which Dr. Hatt (1940, p. 537) regards as a race of *carillus*. It is much brighter tawny above than *H. d. denniae* and its races, or than *H. a. weileri*, has 1—2=6 mammae, a tail slightly pencilled, hind feet with a slight clouding of darker at the base of the toes but without dark tarsal mark. The edges of the frontal are strongly beaded, with a minutely projecting point just in advance of the parietal. The immature specimen is dark, with only a sprinkling of minute tawny tips, especially on the head, and very dark metatarsal area and white toes. This identification, if correct, carries the range eastward to the extreme edge of the Congo region.

Measurements. ♀. 100. 137. 19. 16 mm., ♀ yng. 80. 100. 17. 14 mm.

Breeding. Taken from a large, loose nest constructed of strips of dry banana-leaf, built in a bunch of wild banana fruit that was hanging upside down. A second young one escaped.

Mastomys coucha ugandae (De Winton)

Mus ugandae De Winton, 1897, Ann. Mag. Nat. Hist. (6), **20**, p. 317: Entebbe, Uganda.

♀ (M. C. Z. 40831) Isunga, near Kibale Forest, U. 14. xii. 38.
5 ♂ 3 ♀ (M. C. Z. 39319–25, 39333) Bundibugyo, U. 20. xii. 38.

Native name. *Bandugi* (Luamba); *ndiakiru* (Lutoro).

Measurements. ♂. 155. 87+. 25. 17 mm., ♀. 145. 120. 27. 18 mm. Both from Bundibugyo.

Mastomys coucha durumae (Heller)

Epimys coucha durumae Heller, 1912, Smithsonian Misc. Coll., **59**, No. 16, p. 9; Mazeras, Kenya Colony.

4 ♂ 3 ♀ (M. C. Z. 39120–5, 39137) Magrotto Mtn., T. T. 10–17. vii. 39.

Native name. *Shishe* (Kisambara).

Discussion. This is a poorly marked race of the hot coastal strip of southeastern Kenya Colony, ranging into the adjacent Tanganyika Territory for an undetermined distance. It is slightly grayer and less brownish than the earlier-described *hildebrandtii* of the Teita Hills region. Externally it much resembles immature examples of the race of *Aethomys kaiseri* occurring in the same region, but is easily distinguished by its shorter and more slender foot, about 25 mm. with claw, and by its somewhat closer pelage. The longer, slit-like incisive foramina at once distinguish the skull.

Measurements. ♂. 145. 126. 22. 19 mm., ♀. 120. 105. 22. 18 mm.

Enemies. Three rats, apparently of this species, recovered from the stomach of a viper (*Bitis gabonica*) killed close to the spot where this series was trapped.

Habitat. Trapped at the edge of a swamp in a valley on the mountain. Two others trapped, had their skulls eaten out by other rats.

Mastomys coucha microdon (Peters)

Mus microdon Peters, 1852, Reise nach Mossambique, Säugeth., p. 149, pl. xxxv, figs. 5–6, pl. xxxvi, fig. 1: Tette & Boror, Mozambique.

♂ (M. C. Z. 38841) Kitaya, T. T. 28. iii. 39.
♀ (M. C. Z. 38874) Mbanja, T. T. 27. iv. 39.

Native names. *Chikukumula* (Kimakonde at Kitaya); *nkule* (Kimakonde at Mbanja).

Discussion. A somewhat paler race than *M. c. ugandae.*

Measurements. ♂. 140. 110. 24. 16 mm., ♀. 122. 107. 22. 18 mm.

Breeding. On April 27, the female held fifteen small embryos (preserved).

Habitat. The male was taken in a depression, lined with a few grasses, beneath a pile of weeds at the edge of a rice swamp — an extremely damp situation.

Leggada bufo bufo Thomas

Leggada bufo Thomas, 1906, Ann. Mag. Nat. Hist. (7), **18**, p. 145: Mubuku Valley, Ruwenzori Mountains, Uganda, 6000 feet.

2 ♂ 4 ♀ (M. C. Z. 40820–2, –4–5, –8) Mihunga, U. 12–18. i. 39.

Native name. Kienje (Lukonjo).

Discussion. These small orange-bellied mice are topotypes. In youngish specimens the color of the belly is much duller than in the adults, gray with a wash of ochraceous.

Measurements. ♂. 85. 61. 15. 11 mm., ♀. 85. 70. 16. 12 mm.

Leggada bufo ablutus subsp. nov.

Type. Museum of Comparative Zoölogy, No. 40745, an adult male, skin and skull, from Upper Mulinga, Idjwi Island, Lake Kivu, Belgian Congo, collected by Arthur Loveridge, February 24, 1939.

Description. Like typical *L. bufo* of Ruwenzori, but distinguished from it by its slightly less-dark dorsal coloring and by its paler under surface in which the gray-based hairs from chin to root of tail have a subterminal ring of whitish and a tip of bright ochraceous buff, producing a wash of this tint rather than the richer 'ochraceous orange' of *bufo.*

The general color above is a uniform mixture of black, finely punctate with orange, hardly darker in the center of the back, but slightly less dark on cheeks and forehead; no subauricular spot and no eye-ring; ears blackish brown, nearly naked; tail blackish above, paler below, minutely haired. Fore feet pale or slightly darkened on the metacarpal area; hind feet similar.

The skull does not differ from that of typical *bufo.* Upper incisors very slightly notched; incisive foramina long, extending back to about the anterior third of the first molar; masseteric knob prominent. First upper molar with three outer and two inner cusps, of which the

antero-external one is small; the antero-internal cusp much behind the transverse level of the former.

Measurements. The collector's measurements of the type and an adult female paratype, respectively, are: head and body, 90, 86 mm.; tail, 70, 75; hind foot, 16, 15; ear, 11, 12. The skull of the type measures: greatest length, 22.0 mm.; basal length, 17.6; palatal length, 10.4; zygomatic width, 10.0; mastoid width, 9.2; width across molars, 4.9.

Remarks. The three adult specimens (M. C. Z. 40745–7) from Lake Kivu are so noticeably paler below than the topotypes of *L. b. bufo* that they seem to represent a local form worth recognition. A similar paling out in color is seen in some other local representatives of small mammals as compared with Ruwenzori specimens, as for example *Dendromus insignis kivu.*

Native name. Muhushushu (Lulega). Despite the similarity in the Lulega names for this small rodent and for the shrews, I was assured that the difference in pronunciation had been correctly transcribed.

Leggada grata grata Thomas & Wroughton

Leggada grata Thomas & Wroughton, 1910, Trans. Zool. Soc. London, **19**, p. 507: Mubuku Valley, Ruwenzori Mountains, Uganda, 6000 ft.

♀ (M. C. Z. 40826) Mihunga, U. 12. i. 39.
♀ (M. C. Z. 40827) Nyakabande, U. 2. i. 39.
6 ♂ 9 ♀ (M. C. Z. 40748–62) Idjwi Id., B. C. 18. ii–3. iii. 39.

Native name. Mpiongo (Lulega).

Discussion. The specimen from Mihunga, Ruwenzori, is topotypic of this species, and though slightly darker above than the Kivu series, perhaps owes this difference to its immaturity. In immature specimens the buffy line at the edge of the belly is not developed.

Measurements. ♂. 78. 57. 13. 10 mm., ♀. 75. 55. 12. 9 mm., both from Idjwi.

Breeding. On February 20, a 75 mm. female was found in her nest of dry grass beneath a heap of garden rubbish. The four young present had their eyes closed, and consisted of a ♂. 43. 33. 11. 5 mm., and three females 43. 35. 11. 5 mm. (preserved).

Enemies. Two recovered from the stomach of a mamba (*Dendroaspis j. kaimosae*) on Idjwi, and two from vipers (*Atheris nitschei*) on Ruwenzori and Idjwi, respectively.

Leggada bella vicina Thomas

Leggada bella vicina Thomas, 1910, Ann. Mag. Nat. Hist. (8), **5**, p. 88: Takaungu, near Mombasa, Kenya Colony.

1 ♂ 2 ♀ (M. C. Z. 38861, 38864–5) Kitaya, Rovuma R., T. T. 29. iii. 39.

1 ♂ 3 ♀ (M. C. Z. 38847–8, 38862–3) Mikindani, T. T. 17–19. iv. 39.

1 ♂ 1 ♀ (M. C. Z. 38846, 38880) Mbanja, near Lindi, T. T. 27. iv. 39.

2 ♂ (M. C. Z. 38866–7) Mainland opp. Kilindini, K. C. 25. vii. 39.

Native names. *Chanile* (Kimakonde at Kitaya); *ngorpo* (Kimakonde at Mbanja); *irutu* (Kimwera).

Discussion. No difference appears between topotypical skins from near Mombasa and those of the southeastern part of Tanganyika. There is some individual variation in the amount of darkening of the back and the intensity of the ochraceous on the sides, partly it seems, a matter of age.

Measurements. ♂. 68. 42. 12. 11 mm., ♀. 68. 46. 12. 10 mm., from opposite Kilindini, and Kitaya, respectively.

Breeding. On March 29, two nests, comprised of a loose assemblage of fine grasses without any lining, were found on the ground beneath piles of (i) thatching grass, (ii) weeds. In addition to the mother mice, they held litters (preserved) consisting of blind and naked nestlings of a very raw red hue, and numbering eight and three respectively.

On April 17, a loosely built nest measuring about 100 mm. (*circa* 4 inches) in diameter, constructed of finely shredded outer leaves of maize, was found on the ground beneath a pile of discarded corncobs and their husks. In addition to the 66 mm. mother, it held seven naked nestlings (preserved), one of which measured *circa* 37. 24. 6. 3 mm.

On April 19, a 67 mm. female held seven fetuses (preserved).

On April 27, a litter consisting of six naked nestlings (preserved) was found.

Diet. Finely masticated maize found in stomach of one mouse.

Enemies. An adult in the stomach of a snake (*Boaedon l. lineatus*) at Kitaya; three large and one small nestling in a burrowing viper (*Atractaspis bibronii*) at Mbanja.

Cricetomys gambianus proparator Wroughton

Cricetomys gambianus proparator Wroughton, 1910, Ann. Mag. Nat. Hist. (8) **5**, p. 107: Mubuku Valley, Ruwenzori Mountains, Uganda, 6000 ft.

1 ♀ (M. C. Z. 40792) Mabira Forest, U. 16. xi. 38.
3 ♂ (M. C. Z. 39420–2) Bundibugyo, U. 20. xii. 38.
1 ♀ (M. C. Z. 39419) Mihunga, U. 13. i. 39.

Native names. Kayozi (Luganda); *msumba* (Luamba and Lutoro); *isisa* not *chicha* (Lukonjo).

Discussion. The specimen from Mihunga is topotypical of *proparator,* dark above, white below, the fore feet white-toed, the hind feet dark with paler toes, tail dark in its basal third. The specimen from Mabira is practically identical with it but has the chest slightly clouded with gray. The three Bundibugyo specimens are slightly more buffy than *proparator,* and are not very different from topotypes of *elgonis.* In one the under side is all white, in another the chest is marked with gray, while in the third the entire lower surface is gray. In their fore feet the condition varies individually from white-toed to having the entire foot white, the hind toes are white and the tails about one-half white.

Dr. R. T. Hatt (1940, p. 493) has remarked at length on the variation shown by these giant rats, especially in the regions where forest and savannah habitats meet or overlap, and on the difficulty of assigning individual specimens to a given race. Without sufficiently representative series it is almost impossible to find sharply delimiting characters for local races. Nevertheless he finds those of the Congo forest rather sharply marked off from those of the eastern savannah, so that he regards them as specifically distinct under the name of *C. dissimilis* (misspelled *dissimulus*). Probably the explanation is that the savannah forms with their clouded bellies and paler, more ochraceous pelage, mingle with the white-bellied, darker-backed forest forms along the eastern outposts of the central forest area, especially where the latter is gradually being driven back so that on the borders of the two habitats the differences become less clear, and the characters more or less intermediate. The case is perhaps somewhat paralleled by those of the forest and savannah elephants, the dwarf and Cape buffaloes, and others, which seem to be pairs of forms living typically either in the forest or in the open country, but due to lack of any but environmental barriers are not yet completely segregated as distinct species. It becomes then a matter of opinion whether to regard them as distinct species or as representative forms of a single species.

Measurements. ♂. 390. 430. 65. 46 mm., ♀. 320. 370. 71. 42 mm., from Bundibugyo and Mihunga, respectively.

Parasites. Hemimerids (———— ————) in fur of the Mabira and Bundibugyo rats, but only a tick (Ixodes rasus) on the Mihunga specimen.

Cricetomys gambianus osgoodi Heller

Cricetomys gambianus osgoodi Heller, 1912, Smithsonian Misc. Coll., **59**, No. 16, p. 16: Mazeras, Kenya Colony.

♂ (M. C. Z. 39423) Nchingidi, T. T. 19. v. 39.

Discussion. This specimen agrees precisely with the characters pointed out by Heller. The mesopterygoid fossa of the skull is narrow and parallel-sided, the bullae are small, and the zygomata are obviously more bowed than in the Uganda specimens; skull length, 72 mm. Compared with the races *proparator* and *elgonis*, the dorsal coloring is buffier, belly clear white, fore feet pale, no light area at the anterior base of the ear.

Lophuromys aquilus aquilus (True)

Mus aquilus True, 1892, Proc. U. S. Nat. Mus., **15**, p. 460, fig. 1: Mt. Kilimanjaro, Tanganyika Territory, 8000 feet.

1 ♂ 2 ♀ (M. C. Z. 39061–3) Magrotto Mtn., T. T. 14–16. vii. 39.

Native name. Vusu (Kisambara).

Discussion. In a previous report (1936, p. 99), with an extensive series of material from Mt. Elgon, it was considered that *rubecula* Dollman, described from Elgonyi, Mt. Elgon, was unrecognizable from the nominate form. The three specimens listed above are slightly less dark above, redder on the sides, and pinker on the belly than those from Ruwenzori and Lake Kivu listed below.

Measurements. ♂. 145. 80. 21. 18 mm., ♀. 144. ?. 22. 18 mm.

Breeding. On July 14, a female held four very small embryos (preserved).

Diet. Palm-oil nut and other matter in one stomach.

Enemies. No parasites, but note loss of tail by both females!

Lophuromys aquilus (subsp.)

♂ (M. C. Z. 39223) Budongo Forest, U. 28. xi. 38.

Discussion. This skin is almost without darkening of black hairs dorsally, but is evenly punctate with black and ochraceous, paler even than the race *zena*, while the belly is pure pinkish ochraceous.

Measurements. ♂. 135. 65. 19. 16 mm.

Diet. Trapped with bread as bait.

Lophuromys aquilus laticeps Thomas & Wroughton

Plate 5, fig. 2.

Lophuromys laticeps Thomas & Wroughton, 1907, Ann. Mag. Nat. Hist. (7), **19**, p. 383: Lake Kivu, Belgian Congo.

1 ♂ 1 ♀ (M. C. Z. 40798–9) Mabira Forest, U. 9 & 17. xi. 38.
1 ♂ juv. (M. C. Z. 39318) Bundibugyo, U. 20. xii. 38.
4 ♂ 3 ♀ (M. C. Z. 39220, 39312–7) Mihunga, U. 10–19. i. 39.
2 ♂ (M. C. Z. 39221–2) Nyakabande, U. 27. i. 39.
1 ♂ 3 ♀ (M. C. Z. 39250–3) Kisenyi, B. R. 10. ii. 39.
7 ♂ 6 ♀ (M. C. Z. 39254–66) Idjwi Id., B. C. 18. ii–3. iii. 39.

Native names. Adulo (Luamba); *kihukuzi* (Lutoro); *kisuhura* (Lukonjo); *ichumba* (Lulega).

Discussion. Individual variation is so great that races of *aquilus* are somewhat questionable, young ones are brighter reddish below than most adults so that the appearance of a series depends to some extent on the average age. The Kisenyi and Idjwi series may be considered topotypic of *laticeps*, to which Hatt assigns his Kisenyi material. Our four specimens from Kisenyi, on the north shore of the lake, are a trifle more ochraceous tawny on the under surface than the Idjwi series in which the tips of the belly hairs are tawny olive, and so short that the pale-gray bases show through, giving a gray-speckled appearance; a few individuals in the Idjwi series, however, are indistinguishable from those of Kisenyi. Apparently, to judge by his map, Hatt would apply the name *rubecula* (discussed above) to the rats of Ruwenzori; it appears impossible, however, to separate our seven Mihunga, Ruwenzori, from the Kivu material. The Ruwenzori series is very dark above, with minute speckling, and buffy gray or bright orange-buff below. Thomas & Wroughton (1910, p. 512) referred their Ruwenzori material to *aquilus*, their single Kivu specimen to *laticeps*.

All are more ochraceous on flanks and shoulders, less blackish on the back, than specimens from Kisiki, Belgian Congo, representing *L. a. rita*, towards which they are perhaps a transitional form.

Measurements. ♂. 141. 82. 20. 16 mm., ♀. 138. 81. 19. 16 mm. Both from Idjwi.

Breeding. In late February, a female held three fetuses *circa* 43 mm. from snout to anus. On March 3, I found a nest constructed of fine grass and large dry leaves, in a spacious cavity formed by the decaying roots of a large tree, which was situated in a small patch of forest. The nest held a 120 mm. female and a younger ♀. 100. 53. 23. 13 mm., which was photographed, vide pl. 5, fig. 2.

Diet. Taken with meat bait.

Parasites. The male from Mabira, like Arvicanthis in the same locality, had numerous scars upon its back as if it had been parasitized by Tumbo fly. Five small ants on a trapped male at Mihunga, behaved like fleas in its fur.

Enemies. On February 19, two new-born young in the stomach of a cobra (*Naja melanoleuca*) and four in that of a mamba (*Dendroaspis j. kaimosae*), two adults in another mamba, one in a viper (*Bitis nasicornis*) at Mabira.

Lophuromys woosnami woosnami Thomas

Lophuromys woosnami Thomas, 1906, Ann. Mag. Nat. Hist. (7), **18**, p. 146: Mubuku Valley, Ruwenzori Mountains, Uganda, 6000 ft.

♂ ♀ (M. C. Z. 39219, 39311) Mubuku Valley, U. 29. xii. 38–4. i. 39.
♀ (M. C. Z. 39218) Mihunga, Ruwenzori Mtns., U. 19. i. 39.

Discussion. In addition to the topotypes listed above, there is a third preserved in alcohol.

Measurements. ♂. 132. 113. 23. 20 mm., ♀. 120. 97. 26. 13 mm., both from Mubuku, latter in alcohol.

Habitat. The alcoholic specimen was trapped at 8 p.m. with cheese bait, the trap being set opposite its hole which was far beneath an overhanging rock in the heart of the forest. Footprints in the dust beneath the rock, attracted attention to the fact that the burrow was occupied.

Acomys wilsoni wilsoni Thomas

Acomys wilsoni Thomas, 1892, Ann. Mag. Nat. Hist. (6), **10**, p. 22: Mombasa, Kenya Colony.

♀ (M. C. Z. 38954) Siga Caves, near Tanga, T. T. 14. vi. 39.

Discussion. This specimen is darker on the back and brighter on the sides than a series of topotypes from Mombasa, but may be included within the range of individual variation.

Measurements. ♀. 90. 52. 10. 12 mm.

Habitat. Caught beneath palm fronds; its ears already in this ragged state.

Acomys ? albigena Heuglin

Acomys albigena Heuglin, 1877, Reise in Nordost-Afrika, **2**, p. 69: Bogos country, Eritrea.

♀ (M. C. Z. 39058) Magrotto Mtn., T. T. 16. vii. 39.

Native name. Kiberakandesi (Kisambara).

Discussion. The single specimen, lacking a tail when trapped, is only tentatively referred to this species. It agrees closely in its dark blackish median area and bright orange-ochraceous sides with a skin from Dembea, Ethiopia, supposed by Dr. W. H. Osgood to represent Heuglin's species, but is widely different from *A. ignitus*, which, from geographical considerations, it might be expected to be.

Measurements. ♀. 110. ?. 15. 15 mm.

Diet. Stomach contents was largely insect remains, mostly unidentifiable, but Dr. P. J. Darlington, who kindly examined them, detects both medium and small-sized beetles.

Dasymys bentleyae medius Thomas

Dasymys medius Thomas, 1906, Ann. Mag. Nat. Hist. (7), **18**, p. 143: Mubuku Valley, Ruwenzori Mountains, Uganda, 6000 ft.

2 ♂ 2 ♀ (M. C. Z. 39224–5, 40832–3) Mihunga, U. 13–17. i. 39.
1 ♀ (M. C. Z. 39149) Idjwi Id., L. Kivu, B. C. 3. iii. 39.

Native name. Chumba (Lulega).

Discussion. The Ruwenzori series is topotypic, and the Lake Kivu specimen is similar to them though with a slightly longer skull than any. We follow Hollister and Hatt in regarding *medius* as a race of *bentleyae*.

Measurements. ♂. 130. 123. 28. 21 mm., ♀. 155. 180. 30. 20 mm. Both from Mihunga, Ruwenzori, 6000 ft.

Breeding. On March 3, a 155 mm. female was suckling two young, of which the ♂ measured 57. 28. 11. 5 mm. (not kept).

Enemies. A large adult recovered from the stomach of a mamba (*Dendroaspis j. kaimosae*) on Idjwi.

Pelomys fallax concolor Heller

Pelomys fallax concolor Heller, 1912, Smithsonian Misc. Coll., **59**, No. 16, p. 13: Kiduha, Lake Mutanda, Uganda.

♂ (M. C. Z. 39146) Kisenyi, B. R. 11. ii. 39.
♂ ♀ (M. C. Z. 39145, 40743) Idjwi Id., B. C. 22. ii. 39.

Native name. Kinosa (Lulega).

Discussion. These three specimens, one (M. C. Z. 40743) of which is young, agree in lacking the dorsal black stripe and the white beneath the forearms and on the belly, as described by Heller, but the supposedly narrower nasals, longer tooth row, and incisive foramina as compared with *P. f. insignatus* do not hold and may have been due to comparison with a specimen of *Mylomys*. In this genus, the validity of which is questionable, the incisive foramina extend backward between the anterior ends of the first molars, instead of stopping on a line with their anterior roots.

Measurements. ♂. 182. 145. 30. 19 mm., ♀. 105. 85. 22. 15 mm., both from Idjwi.

Pelomys fallax insignatus Osgood

Pelomys fallax insignatus Osgood, 1910, Ann. Mag. Nat. Hist. (8), **5**, p. 276: Fort Hill, northern Nyasaland.

1 ♀ (M. C. Z. 38842) Nchingidi, T. T. 17. v. 39.
2 ♀ (M. C. Z. 38956–7) Magrotto Mtn., T. T. 17. vii. 39.

Native name. Mende (Kisambara).

Discussion. This race lacks the black dorsal stripe and has whitish-tipped hairs over the inguinal area and under surface of the forearms. In the youngest specimen (M. C. Z. 38957) there is a broad dark band in the mid-dorsal area where the yellow-ringed hairs have not yet come in. These specimens agree closely with one from Tukuyu, in the southwestern part of Tanganyika Territory, secured by Loveridge in 1930, and now extend the recorded range to the coastal area in northeastern Tanganyika.

Measurements. ♀. 158. 131. 28. 18 mm., from Magrotto Estate.

Arvicanthis abyssinicus nubilans Wroughton

Arvicanthus (sic) *abyssinicus nubilans* Wroughton, 1909, Ann. Mag. Nat. Hist. (8), **4**, p. 539: Kisumu, Kenya Colony.

3 ♂ 3 ♀ (M. C. Z. 40802–7) Mabira Forest, U. 12–19. xi. 38.
2 ♂ 3 ♀ (M. C. Z. 39226–8, –30–1) Budongo Forest, U. 25. xi. 38.
3 ♂ 5 ♀ (M. C. Z. 39291–8) Bundibugyo, U. 20. xii. 38.
1 ♂ (M. C. Z. 39229) Bugoye, U. 23. i. 39.
1 ♂ (M. C. Z. 39147) Nyakabande, U. 7. ii. 39.

Native names. *Mese* (Luganda); *Mbabu* (Luamba); *mbeba* (Lutoro).

Discussion. The series is uniform in color, with a faint buffy tinge over the shoulders, due to the pale-ochraceous subterminal bands on the hairs, deepening on the lower back to ochraceous. The dorsal black line is barely indicated, though traceable.

Measurements. ♂. 175. 135. 32. 21 mm., ♀. 160. 115. 28. 20 mm., both from Mabira.

Eremics. One Mabira female had lost a hind leg but the skin was completely healed.

Lemniscomys striatus massaicus (Pagenstecher)

Mus (*Lemniscomys*) *barbarus* L. var. *massaicus* Pagenstecher, 1885, Jahrb. Hamburg. Wiss. Anstalt, **2**, p. 45: Lake Naivasha and Nguruman, Kenya Colony.

2 ♂ (M. C. Z. 40800–1) Mabira Forest, U. 9. xi. 38.
1 ♂ 1 ♀ (M. C. Z. 39212,–302) Kibale Forest, U. 15. xii. 38.
2 ♂ 2 ♀ (M. C. Z. 39303–6) Bundibugyo, U. 20. xii. 38.
2 ♂ 1 ♀ (M. C. Z. 39211,–3,–301) Mihunga, U. 12–18. i. 39.
2 young (M. C. Z. 39214–5) Bugoye, U. 23. i. 39.

Native names. *Mende* (Luganda); *besi* (Luamba); *nyaruveri* (Lutoro); *lusense* (Lukonjo).

Discussion. The Ruwenzori skins tend to be decidedly more grayish on nape and flanks, lacking the ochraceous tint of the others. The length of the hind foot, without claws, in the dried skins of all these specimens, is uniformly 25–26 mm., hence none is referable to *L. m. maculus* of Mokia,[1] southeast of Ruwenzori, in which the foot is 21–23 mm.

Measurements. ♂. 130. 136. 26. 17 mm., ♀. 127. 130. 25. ?. mm., both from Mihunga.

[1] Mohokya, twenty miles south of Bugoye.

Breeding. On November 14, four nestlings (measuring 50. 35. 12. 5 mm.) were found by men engaged in clearing undergrowth at Mabira.

On December 15, a 125 mm. female held five small fetuses, at Kibale.

On December 20, a 122 mm. female held five small fetuses, at Bundibugyo.

On January 18, two blind nestlings were brought in at Mihunga.

On January 23, two young (measuring 64. 45. 15. 7 mm.), their eyes still unopened, were brought in at Bugoye.

On January 25, young were brought in, but not preserved, at Nyakabande.

Parasites. Mites (——— ———) and maggots (*Stasisia rodhaini*) removed from myiasis-infected rats at Mabira.

Otomys denti Thomas

Otomys denti Thomas, 1906, Ann. Mag. Nat. Hist. (7), **18**, p. 141: Mubuku Valley, Ruwenzori Mountains, Uganda, 6000 ft.

2 ♂ (M. C. Z. 39204–5) Mihunga, U. 4 & 18. i. 39.

Native names. *Kitwamusanzi* (Lukonjo); *kihukuzi* (Lutoro).

Discussion. These topotypes, having been taken at the Ruwenzori Expedition's (1905) camp, agree perfectly with Thomas's description in having the outer section of the lower incisors white, in having five laminae to the last upper molar, in their all-black tails, and under side darker, and with much less ochraceous speckling, than in *O. kempi.*

Measurements. ♂. 160. 95. 27. 21 mm.

Otomys kempi Dollman

Otomys kempi Dollman, 1915, Ann. Mag. Nat. Hist. (8), **15**, p. 152: Mt. Mikeno, Belgian Ruanda, 6000 feet.

2 ♂ (M. C. Z. 39299–300) Mabira Forest, U. 12 & 15. xi. 38.
1 ♂ (M. C. Z. 39206) Kibale Forest, Toro, U. 13. xii. 38.
1 ♀ (M. C. Z. 39148) Idjwi Id., L. Kivu, B. C. 3. iii. 39.

Discussion. These specimens add slightly to the recorded distribution, though Dollman has reported *kempi* from Buhamba, near Lake Kivu. The species is characterized by the possession of one groove on the lower incisor and six laminae to the last upper molar. Contrary to Dollman's account, however, the portion of the lower incisor external to the groove is not always white but is yellow in all four of the above

specimens, and the tails are distinctly pale beneath. The lower surface has the bases of the hairs less blackish and with longer, more abundant buffy tips than *O. denti*.

Measurements. ♂. 165. 75. 26. 20 mm., from Mabira.

BATHYERGIDAE

Cryptomys hottentotus whytei (Thomas)

Georychus whytei Thomas, 1897, Proc. Zool. Soc. London, p. 432: Karonga, Lake Nyasa, Nyasaland.

♂ (M. C. Z. 38955) Ujiji, T. T. 13. iii. 39.

Discussion. The single specimen is in very thin and much-worn pelage so that the true color characters are indeterminable, but shows four small white areas on the forehead. It agrees in its small foot and general cranial characters with specimens from southwestern Tanganyika, which we previously (1933, p. 124) referred to *C. h. whytei*. The premaxillaries slightly exceed the nasals in posterior extension, but do not approximate each other or close behind them as they do in the *occlusus* of Kigogo. In May 1930, on an earlier visit to Lake Tanganyika, Loveridge also obtained a solitary example of this species at Ujiji, which must be about the northern limit of its range.

Measurements. ♂. 145. 18. 19. 2 mm.

HYSTRICIDAE

Hystrix africaeaustralis ?subsp.

♂ (M. C. Z. 39407) Kitaya, T. T. 2. iv. 39.

Native names. Ndinu (Kiyao); *nungu* (Kimakonde).

Discussion. This is a young specimen with only the two anterior cheek teeth in place on each side, so that it offers no characters that would ensure its reference to any one of the four races named from Tanganyika Territory. In spite of its youth, the length of the frontals is more than half that of the nasals and twice the distance from the posterior edge of the frontals to the point of the occiput, thus agreeing with the adult *H. africaeaustralis*.

Measurements. ♂ juv. 320. 60. 60. 34 mm.

Enemies. This little creature with both fore and hind foot missing on the right side, though the stumps are entirely healed, was found in a maize shamba, and brought to me alive.

LEPORIDAE

Lepus capensis ?abbotti Hollister

Lepus capensis abbotti Hollister, 1918, Proc. Biol. Soc. Washington, **31**, p. 35: Plains east of Mt. Kilimanjaro, Tanganyika Territory.

♂ ♀ (M. C. Z. 38878–9) Mikindani, T. T. 15. iv. 39.

Frequently seen at night on the roads near Mbanja, near Lindi, T.T.

Native names. Chungula (Kimwera); *usungula* (Kimakonde at Kitaya); *uyungula* (Kimakonde at Mbanja).

Discussion. These two leverets are so young that they are referred to the race *abbotti* on geographical grounds only. As is usual in young hares, both have a prominent white blaze on the forehead.

Measurements. ♂ and ♀. 190. 25. 56. 47 mm. Though external dimensions of both were alike, the skull of the male was surprisingly larger than that of the female.

SUIDAE

Hylochoerus meinertzhageni meinertzhageni Thomas

Hylochoerus meinertzhageni Thomas, 1904, Nature (London), **70**, p. 577: Kakamega Forest, near Kaimosi, Kenya Colony (see Loveridge, A., in Allen, G. M., and Lawrence, B., 1936. Bull. Mus. Comp. Zoöl., **79**, p. 109).

2 skulls (M. C. Z. 39428–9) Nyinabitaba, U. 19. i. 39.

Habitat. Quite by accident, as we were packing up to leave the Ruwenzori Mountains, I learned that the Bakonjo were regularly killing giant forest hogs at Nyinabitaba, higher up the mountain above the Mubuku Valley. The skulls were prepared from heads which the hunters were carrying past our camp.

BOVIDAE

Cephalophus caerulus aequatorialis Matschie

Cephalolophus (sic) *aequatorialis* Matschie, 1892, Sitzb. Ges. Naturf. Freunde Berlin, p. 112: Chagwe, Uganda.

♀ (M. C. Z. 39405) Mabira Forest, Chagwe, U. 16. i. 38.
♀ (M. C. Z. 39406) Kibale Forest, Toro, U. 15. xii. 38.

Native names. Ntalaganiya (Luganda); *nendi* (Lutoro and Lukonjo).

Discussion. The topotype from Mabira has a small rudiment of a horn core at the posterior margin of each frontal. It still retains the milk premolars and the last permanent molar is nearly in place.

Measurements. ♀. 620. 100. 160. 52 mm., from Mubango, Mabira Forest.

Breeding. Neither of these blue forest duikers was pregnant.

Sylvicapra grimmia ?roosevelti Heller

Sylvicapra grimmia roosevelti Heller, 1912, Smithsonian Misc. Coll., **60**, No. 8, p. 9: Rhino Camp (former Lado Enclave), Uganda.

♂ juv. (M. C. Z. 39424) Bundibugyo, U. 20. xii. 38.

Native name. *Abudi* (Luamba).

Discussion. This is a very young duiker with milk dentition, consequently its subspecific identification with *roosevelti* is solely on geographical probabilities and remains uncertain.

Measurements. ♂. 350. 55. 142. 46 mm.

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EXPLANATION OF PLATES

PLATE 1

PLATE 1

Map showing Principal Collecting Localities

1938

Landing at Mombasa (25.x), except for a stopover at Naivasha and Kinangop (26–31.x), Loveridge proceeded by rail direct to Jinja (1–5.xi). Thence to Mabira Forest (5–21.xi), Budongo Forest (22.xi–7.xii), Kibale Forest (8–19.xii), Bundibugyo near Bwamba Forest (19–26.xii), Bugoye, foot of Ruwenzori Mountains (26–28.xii) and Mubuku Valley at 7000 ft. (29.xii–).

1939

On leaving Mubuku (–9.i) Loveridge descended down the valley to Mihunga, *circa* 6000 ft. (9–21.i), then back to Bugoye (21–24.i), Nyakabande (25–30.i), Mushongero (30.i–4.ii), returned to Nyakabande (4–8.ii); Kisenyi (8–13.ii), Goma (13–14.ii), Mamvu on Idjwi Island (14–16.ii), Upper Mulinga on Idjwi (16.ii–6.iii), Uvira (7–8.iii), Ujiji (9–16.iii), Dar es Salaam (18–19.iii), Mikindani (22–24.iii), Kitaya (24.iii–7.iv), Mikindani (7–24.iv), Mbanja (25.iv–6.v), Lake Rutamba (6–8.v), Nchingidi (9–21.v), Lindi (22.v–4.vi), Siga Caves (7–17.vi), Amboni Estate (17–27.vi), Magrotto Mountain (27.vi–21.vii), Tanga (21–23.vii), Kilindini (24–26.vii).

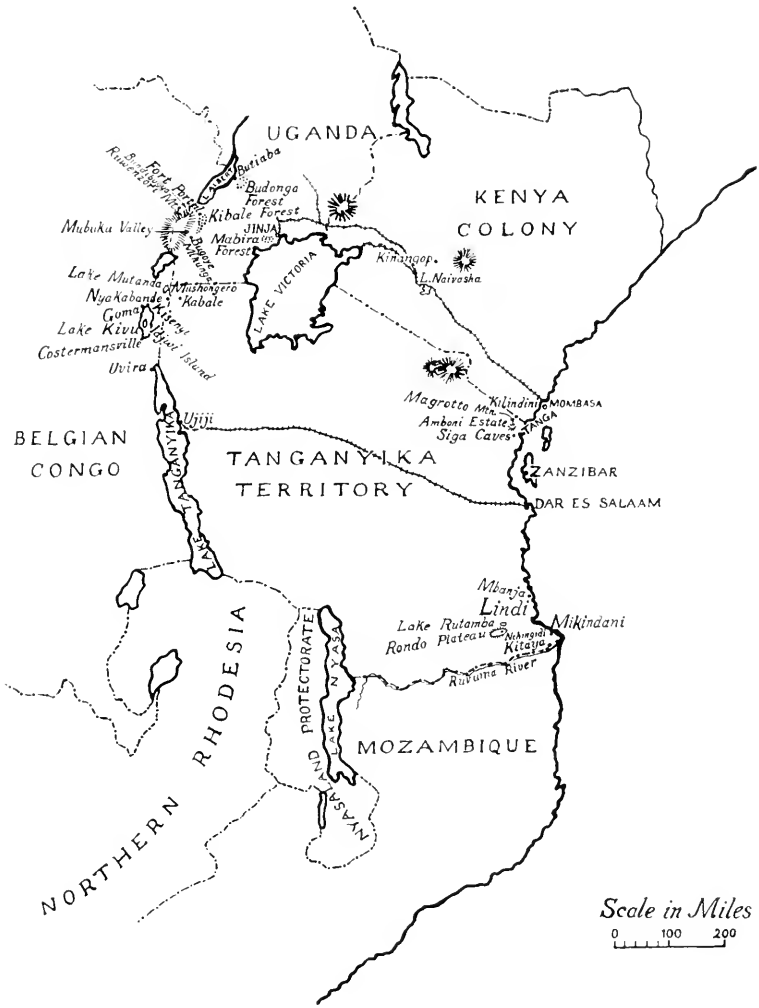
UGANDA
KENYA COLONY
BELGIAN CONGO
TANGANYIKA TERRITORY
ZANZIBAR
DAR ES SALAAM
MOMBASA
MOZAMBIQUE
NORTHERN RHODESIA
NYASALAND PROTECTORATE
LAKE VICTORIA
LAKE TANGANYIKA
LAKE NYASA
Butiaba
Budonga Forest
Kibale Forest
JINJA
Mabira Forest
Mubuku Valley
Ruwenzori
Lake Mutanda
Nyakabanda
Kabale
Guma
Lake Kivu
Costermansville
Idjwi Island
Uvira
Ujiji
Kinangop
L. Naivasha
Magrotto Mts.
Kilindini
Amboni Estate
Siga Caves
Mbanja
Lindi
Mikindani
Lake Rutamba
Rondo Plateau
Nihingidi
Kitaya
Rufuma River
Scale in Miles
0 100 200

PLATE 2

PLATE 2

Fig. 1. Chimpanzee (*Pan troglodytes schweinfurthi*)

Apart from this young animal, offered for sale by its native owner at Bundibugyo, the only living chimpanzee seen during the course of the expedition was near Mihunga, on the eastern slopes of Ruwenzori. There, one afternoon, an old animal climbed a lone tree on a knoll and watched us intently as we hunted frogs in the swamp scarcely two hundred yards away.

Fig. 2. Patas Monkey (*Erythrocebus patas pyrrhonotus*)

This was a captive animal in the possession of Mr. J. L. Jarvis, on whose estate near Jinja it was photographed. No other Patas monkeys were seen during the present expedition, their range, in general, being further north. On a previous safari they were frequently seen in the thornbush regions of Karamojo.

1

2

PLATE 3

PLATE 3

Fig. 1. Galago (*Galago demidovii thomasi*)

These small galagos make delightful pets. One, though of another species, captured at Nchingidi, was carried about for a month until it escaped into the forest at Amboni. There its kind were so abundant that just before dawn several pairs of glowing eyes might be seen in the beam of a single electric torch.

Fig. 2. Tree Pangolin (*Phataginus tricuspis mabirae*)

The Mabira Forest would appear to be the most easterly point reached by the African tree pangolin. This eastern form differs in certain respects from its Cameroon congener and is therefore described as new. The above photograph is of the male type which, having been captured by a native in the nearby forest, was brought into camp at Mubango.

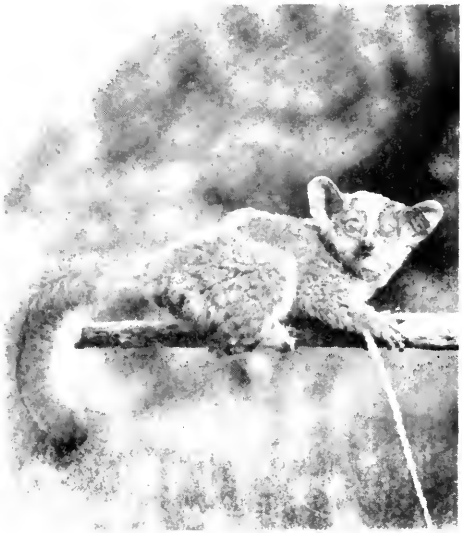

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PLATE 4

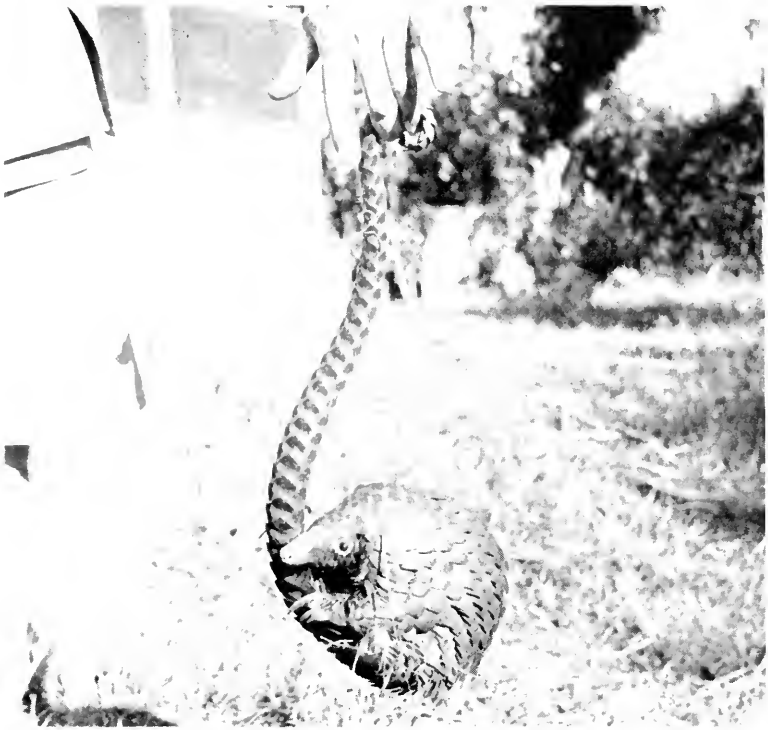
PLATE 4

Fig. 1. Tree Pangolin using its prehensile tail

Unlike the pangolin of the savanna, this species is associated with forest where it is said to climb trees in search of the arboreal termites on which it preys. Its powerful claws serve a useful purpose in digging out the termitaria, after which the elongate and viscous tongue is employed to take up the insects.

Fig. 2. Tree Pangolin in defensive attitude

Despite a certain similarity in defensive technique and general appearance, the African pangolins are not near relatives of the South American armadillos. When teased they are apt to uncoil and recoil with such startling suddenness that a bystander may receive quite a blow from the shielded tail.



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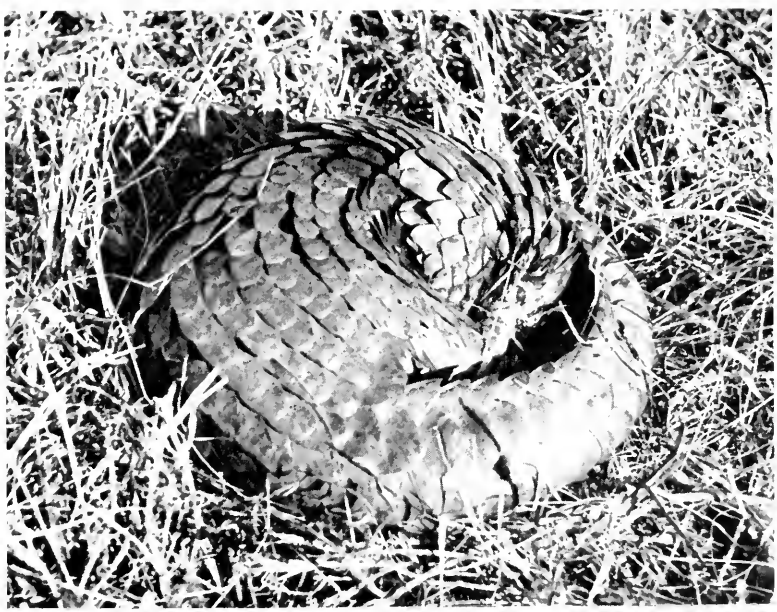

2

PLATE 5

PLATE 5

Fig. 1. Banana Mice (*Dendromus messorius ruddi*)

These attractive little creatures, their eyes already open, were found in their nest at Bugoye on January 23. As we were about to leave, we took them on to Nyakabande where we released them a week later.

Fig. 2. Harsh-furred Mouse (*Lophuromys aquilus laticeps*)

Together with its mother, this well-grown youngster was found in a nest composed of fine grass and dry leaves deep in a cavity among the roots of a forest tree on Idjwi Island, Lake Kivu.

Fig. 3. Dormouse (*Claviglis murinus soleatus*)

In many parts of the country these gentle little gray dormice are not so common as formerly, according to the natives, who attribute their diminution to the spread of the omnivorous roof rat (*Rattus r. kijabius*).

1

2

3

Bulletin of the Museum of Comparative Zoölogy
AT HARVARD COLLEGE
VOL. LXXXIX, No. 5

SCIENTIFIC RESULTS OF A FOURTH EXPEDITION TO FORESTED AREAS IN EAST & CENTRAL AFRICA

II

BIRDS

BY JAMES LEE PETERS AND ARTHUR LOVERIDGE

WITH THREE PLATES

CAMBRIDGE, MASS., U. S. A.
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No. 5.— *Scientific Results of a Fourth Expedition to Forested Areas in East and Central Africa*

II

Birds

By James Lee Peters and Arthur Loveridge

CONTENTS

INTRODUCTION

The collection on which the following report is based, was made by the junior author while investigating the herpetological fauna of certain forested regions in East and Central Africa. The enquiry was carried out on behalf of the Museum of Comparative Zoölogy with a fellowship granted by the John Simon Guggenheim Memorial Foundation of New York.

The period of collecting birds was from November 8, 1938, to July 13, 1939, during which time 809 skins representing 246 species or races of birds were secured. Though 63 of these had never been taken before by the junior author, as the localities visited were in new faunal areas, only 10 were new to the collections of the Museum of Comparative Zoölogy, which are rapidly nearing completion for this general region.

Of the additions, only one, an Apalis, of which eight examples were obtained on Idjwi Island, Lake Kivu, is described as new (p.252). Besides discussions on variation and synonymy, field notes are included on diet, breeding, etc. As on previous occasions, considerable trouble was taken to secure the names applied by the various tribes, *in whose district the species in question was secured,* as such names are frequently not being learned by the rising generation of natives who are more concerned with the impact of civilization.

A synopsis of the itinerary is given in the caption accompanying plate 1 — a map showing principal collecting localities. Altitudes and detailed information regarding the various camps will be furnished in

the final report of this series dealing with the general conclusions arrived at regarding distribution.

For permission to use the blocks of plates 2 and 3, we are indebted to the Editor of the *Scientific Monthly*, in which journal (June and July, 1940) they appeared as illustrations to a popular account of the safari.

We take this opportunity of thanking Dr. J. P. Chapin for pointing out that the Apalis was new, for the loan of comparative material, and for giving us the benefit of his valued opinion on half-a-dozen doubtful forms. To Mr. R. E. Moreau we are indebted for scanning the manuscript and making helpful suggestions based on his unrivalled knowledge of the birds of eastern Tanganyika. Where differences in rendering of bird names occurs as between his recorded in the Usambara Mountains and those obtained on Magrotto Mts. they are to be attributed to local dialect, those obtained by Mr. Moreau being the purer. We are also grateful to our colleague Dr. Joseph Bequaert for identifying ectoparasites, and to Drs. B. Schwarz and J. T. Lucker, of the United States Department of Agriculture, for similar courtesies regarding entoparasites.

A selection of duplicates of such species, including a pair of the new Apalis, as were collected in the Belgian Congo, will be sent to the Congo Museum, Tervueren, in appreciation of the action of His Excellency the Governor of the Congo Belge in granting permission to collect on Idjwi Island.

INDEX TO FAMILIES

Systematic Discussion

PHALACROCORACIDAE

Phalacrocorax carbo lugubris Rüppell

Phalacrocorax lugubris Rüppell, 1845, Syst. Uebers., p. 134, pl. 50: Ethiopia.

♂ ♀ (M. C. Z. 270601–2) Mushongero, U. 1. ii. 39.

Both immature, the wings being 325 and 322 mm. respectively; foreneck brownish, while beneath the ♂ is black and the ♀ mottled.

Native name. *Masoru* (Lugezi).

Breeding. These birds formed part of a huge colony on an island in Lake Mutanda, but inspection of the nests (pl. ii, fig. 2) appeared to indicate that the young had recently fledged.

Diet. Catfish in stomach.

Haliëtor africanus africanus (Gmelin)

Pelecanus africanus Gmelin, 1789, Syst. Nat., **1**, pt. 2, p. 577: Africa.

♂ (M. C. Z. 270603) Mushongero, U. 2 ii. 39.

Native name. *Lugano* (Lugezi).

ARDEIDAE

Egretta garzetta dimorpha Hartert

Egretta dimorpha Hartert, 1914, Bull. Brit. Orn. Club, **35**, p. 14: southeast coast of Madagascar.

♂ ♀ (M. C. Z. 270604–5) Siga Caves, T. T. 15. vi. 39.

The ♂ is in worn post-nuptial gray plumage with a single white feather in the left wing; wing 275 mm., bill 89 mm., tarsus 103 mm. The ♀ is immature, the legs being black, the feet sea green. As the Museum of Comparative Zoölogy has a breeding pair of the white phase with nuptial plumes, shot at Dar es Salaam on 27.vi.18, the possibility of these birds from Siga, near Tanga, being wanderers from Madagascar, should not be overlooked.

Diet. Stomach of ♂ held the following: 2 tadpoles of *Rana boulengeri*, 2 young *Rana m. mascareniensis*, 2 young tailed *Hemisus m. marmoratum*, and 10 crabs; that of the female held indeterminate matter.

SCOPIDAE

Scopus umbretta bannermani Grant

Scopus umbretta bannermani C. Grant, 1914, Bull. Brit. Orn. Club, **35**, p. 27: Mt. Leganisho, Kenya Colony.

♀ (M. C. Z. 270606) Mikindani, T. T. 18. iv. 39.

Wing 305 mm.

Native name. Chengo (Kimakonde).

Diet. A beetle (*Dytiscus*), many rat-tailed maggots (*Eristalis*), a grasshopper and numerous caterpillars.

CICONIIDAE

Dissoura episcopus microscelis (Gray)

Ciconia microscelis G. R. Gray, 1848, Gen. Birds, **3**, p. 561, pl. cli: No locality. South Africa (restricted Mackworth Praed).

♂ (M. C. Z. 270607) Mbanja, T. T. 2. v. 39.

One of three woolly-necked storks feeding in the sea during forenoon.

Native name. Korongo (Kimakonde).

PLEGADIDAE

Hagedashia hagedash ? erlangeri Neumann

Hagedashia hagedash erlangeri Neumann, 1909, Ornis, **13**, p. 193: Dogge, South Somaliland.

Breeding. On January 30, 1939, at Mushongero, Lake Mutanda, two hard-set eggs were brought in by a native, who pointed out the bird to me. The eggs are somewhat richer in coloring than an authenticated clutch obtained at Shanwa and the possibility of their belonging to the race *nilotica* should not be overlooked.

ANATIDAE

Anas undulata undulata Dubois

Anas undulata Dubois, 1837, Orn. Gall., **1**, p. 119, pl. lxxvii: Cape of Good Hope.

♀ (M. C. Z. 270608) Nyakabande, U. 28. i. 39.

♂, 3 ♀ ♀ (M. C. Z. 270609–12) Mushongero, U. 31. xii. 38 & 1. ii. 39

Native name. Matanga (Lugezi).

Nyroca erythrophthalma (Wied)

Anas erythrophthalma Wied, 1832, Beitr. Nat. Bras., **4**, p. 929: Lagoa do Braço, near Villa de Belmonte, Bahia, Brazil.

2 ♂♂, 6 ♀♀ (M. C. Z. 270613–20) Mushongero, U. 1. ii. 39.

M. Delacour (1937, Bull. B. O. C., **57**, p. 157) has proposed *Phoecoaythia* as a substitute name for his genus *Phoeonetta* (preoccupied) for this duck, formerly included in *Nyroca*. At the present time we hesitate to discuss as to whether the genus should be recognized.

Native name. *Mahinda* (Lugezi).

Dendrocygna viduata (Linnaeus)

Anas viduata Linnaeus, 1766, Syst. Nat. ed. 12, **1**, p. 205: Cartagena, Colombia.

♂ (M. C. Z. 270621) Kitaya, T. T. 28. iii. 39.

Sarkidiornis melanota (Pennant)

Anser melanotus Pennant, 1769, Ind. Zool., p. 12, pl. xi: Ceylon.

♀♀ (M. C. Z. 270622–3) Mushongero, U. 2. ii. 39.

Native name. *Mifewe* (Lugezi).

ACCIPITRIDAE

Machaerhamphus alcinus anderssoni (Gurney)

Stringonyx anderssoni Gurney, 1866, Proc. Zool. Soc. London for 1865, p. 618: Otjimbingue, Damaraland, Southwest Africa.

♂ (M. C. Z. 270624) Siga Caves, T. T. 12. vi. 39.

Diet. Stomach held a bat (*Coleura afra*), the species being abundant in the caves near which the hawk was shot in the gloaming.

Milvus migrans migrans (Boddaert)

Falco migrans Boddaert, 1783, Tabl. Pl. Enl., p. 28, no. 472: No locality. France (Hartert).

Migration. On November 1, 1938, at Tororo, Uganda, large numbers of these kites filled the trees both east and west of the station, about thirty birds occupied one tree near where the train stopped. On February 7, 1939, at Nyakabande, Uganda, a large flight arrived from the southeast at sunset to settle in nearby trees.

ACCIPITER TACHIRO SPARSIMFASCIATUS (Reichenow)

Astur sparsimfasciatus Reichenow, 1895, Orn. Monatsb., **3**, p. 97: Zanzibar.

♀ (M. C. Z. 270625) Mikindani, T. T. 19. iv. 39.
♀ (M. C. Z. 270626) Mbanja, T. T. 28. iv. 39.

The latter trapped by a native, who has removed some of the flight feathers.

Native name. *Chiuhiuda* (Kimakonde).

Breeding. Ovules small in the Mikindani bird.

Diet. A moderate sized bird in stomach of same.

ACCIPITER BADIUS POLYZONOIDES Smith

Accipiter polyzonoides A. Smith, 1838, Ill. Zool. S. Africa, Aves, pl. 11: "N. of 26° S. lat.," probably near Mafeking.

♂ (M. C. Z. 270627) Mikindani, T. T. 11. iv. 39.

Native name. *Narumanga* (Kimakonde).

Diet. Stomach held three diurnal geckos (*Lygodactylus p. picturatus*).

ACCIPITER MINULLUS TROPICALIS Reichenow

Accipiter minullus tropicalis Reichenow, 1898, Journ. f. Orn., p. 139: East Africa.

♂ (M. C. Z. 270628) Mikindani, T. T. 14. iv. 39.

Despite remarks by Friedmann (1930, Bull. 153, U. S. Nat. Mus., p. 64) to the contrary, *intermedius* and *tropicalis* appear to us to be recognizable races.

Native name. *Naluri* (Kimakonde).

Breeding. Testes small.

Diet. Stomach held a gecko (*Lygodactylus p. picturatus*) and grasshopper.

MELIERAX GABAR (Daudin)

Falco gabar Daudin, 1800, Traité, **2**, p. 87: interior of S. Africa (*ex* Levaillant).

♀ (M. C. Z. 270629) Kitaya, T. T. 3. iv.39.

Native name. *Nancheka* (Kimakonde).

This bird, which has been examined by Dr. Chapin also, is in immature plumage.

Buteo rufofuscus augur (Rüppell)

Falco (Buteo) augur Rüppell, 1836, Neue Wirbelth., Vögel, p. 38, pl. xvi: Ethiopia.

♂ (M. C. Z. 270630) Idjwi Id., B. C. 26. ii. 39.

The melanistic form, shot on the mountain dominating the island.

Breeding. On January 30, 1939, at Mushongero, Uganda, two slightly incubated eggs were brought in by a native.

Diet. Stomach held rodent fur.

Buteo oreophilus Hartert & Neumann

Buteo oreophilus Hartert & Neumann, 1914, Orn. Monatsb., **22**, p. 31: Koritscha, s. Ethiopia.

♀ (M. C. Z. 270631) Mubuku Valley, U. 4. i. 39.
♀ (M. C. Z. 270632) Mihunga Ridge, U. 18. i. 39.

Native name. Ibebe (Lukonjo and Lutoro).

Diet. Stomach held mouse.

Parasites. Lice preserved on 18.i.39.

Kaupifalco monogrammicus (Temminck)

Falco monogrammicus Temminck, 1824, Pl. Col., livr. 53. pl. ccexiv: Senegal.

♂ ♀ ♀ (M. C. Z. 270633–5) Kitaya, T. T. 28–30. iii. 39.
♂ (M. C. Z. 270636) Mikindani, T. T. 17. iv. 39.
♂ (M. C. Z. 270637) Mbanja, T. T. 28. iv. 39.
♂ (M. C. Z. 270638) Amboni Estate, T. T. 14. vi. 39.

All birds in the series are moulting, so wing measurements misleading.

Native names. Chitotola (Kiyao); *ualumanga* (Kimakonde).

Breeding. On March 28, 1939, both ♀ ♀ held small ovules.

Diet. Stomachs held frog, cricket (*Brachytrypetes membranaceus*), and grasshopper at Kitaya; praying mantis at Mikindani; lizard (*Gerrhosaurus n. nigrolineatus*), skink (*Mabuya r. varia*), and grasshopper at Mbanja; lizard (*G. n. nigrolineatus*), blind snake (*Typhlops u. unitaeniatus*), and grasshopper at Amboni.

Lophaëtus occipitalis (Daudin)

Falco occipitalis Daudin, 1800, Traité, **2**, p. 40: Anteniquoi country, *i.e.* Knysna district, Cape Province.

♂ ♂ ♀ (M. C. Z. 270639–41) Magrotto Mtn., T. T. 3 & 13. vii. 39.

Native name. *Seuchungi* (Kisambara).

Diet. Stomach of one held rat fur, those of the others, shot at 8 a.m. and 4 p.m. respectively, were empty.

Stephanoaëtus coronatus (Linnaeus)

Falco coronatus Linnaeus, 1766, Syst. Nat. ed. 12, **1**, p. 124: Guinea, *i.e.* West Africa.

Diet. There were three crowned hawk-eagles frequenting the forest in the vicinity of my camp on Magrotto Mountain, and though they roosted in the trees just across the valley from my tent, they were always out of gunshot. One day as Mr. Clausen, manager of the near-by plantation, was approaching the oil-nut factory, one of these great birds dropped from the sky and seized the full-grown cat which lived at the factory. This animal throve on the numerous rats and was rather wild, so one might have supposed it would have been able to give a good account of itself; actually it was powerless in the formidable talons. The eagle carried it to a nearby tree, and Clausen, hoping to get the bird for me, dispatched a boy for his gun; before it arrived, however, the eagle, disturbed by some noisy natives, flew away.

Aquila rapax rapax (Temminck)

Falco rapax Temminck, 1828, Pl. Col. livr. 76, pl. cccclv: South Africa.

♀ (M. C. Z. 270642) Nyakabande, U. 7. ii. 39.

Breeding. Ova small.

Necrosyrtes monachus pileatus (Burchell)

Vultur pileatus Burchell, 1824, Travels, **2**, p. 195: Country south of Orange River, *i.e.* Hopetown district, Cape Province.

♂ ♀ (M. C. Z. 270643–4) Mikindani, T. T. 10. iv. 39.

Native name. *Dilembo* (Kimakonde).

Breeding. Gonads small.

Gypohierax angolensis (Gmelin)

Falco angolensis Gmelin, 1788, Syst. Nat., **1**, p. 252: Angola.

♂ ♂ (M. C. Z. 270645–6) Magrotto Mtn., T. T. 14. vii. 39.

Native name. *Nyumbwi* (Kisambara).

Diet. Both stomachs full of palm nuts from the Magrotto Estate.

Parasites. Hippoboscids (*Lynchia dukei*) in plumage.

Gymnogenys typicus typicus (Smith)

Poloboroides [sic] *typicus* A. Smith, 1830, S. Afr. Quart. Journ. (1), p. 107: Eastern Cape Province.

♂ (M. C. Z. 270647) Kitaya, T. T. 28. iii. 39.
♀ (M. C. Z. 270648) Mikindani, T. T. 20. iv. 39.
♀ (M. C. Z. 270649) Mbanja, T. T. 28. iv. 39.

Native name. *Lipupilambugu* (Kiyao); *namakongolo* (Kimakonde at Kitaya); *narufi* (Kimakonde at Mbanja).

Breeding. On March 28, and April 28, testes and ovules small.

Diet. Stomach of one held two nestling weavers which had been swallowed whole.

Circaëtus cinereus Vieillot

Circaëtus cinereus Vieillot, 1818, N. Dict. d'Hist. Nat., **23**, p. 445: Senegal.

♀ (M. C. Z. 270650) Mbanja, T. T. 28. iv. 39.
♀ (M. C. Z. 270651) Amboni Estate, T. T. 24. vi. 39.

Diet. Stomach of first held three snakes (*Psammophis s. sudanensis*); of the second, four snakes (*P. s. sudanensis*, *P. s. sibilans*, and *Causus defillippi*).

Parasites. Hippoboscids (*Pseudolynchia canariensis*) in plumage.

FALCONIDAE

Falco tinnunculus rufescens (Swainson)

Falco rufuscens [sic] Swainson, 1837, Birds West Africa, **1**, p. 109: Senegal (presumed)

♀ (M. C. Z. 270652) Mihunga Ridge, U. 12. i. 39.

Owing to the difficulty of identifying single skins of this hawk, the senior author submitted it to Dr. J. P. Chapin, who writes: "This bird belongs to the dark resident race of the edges of the Ituri forest, which I have called *rufescens* and most other people *carlo*, including you in your Check List. It has always seemed to me that while females from N. E. Africa look very like females from N. E. Congo, the males in the homeland of *carlo* are much less heavily barred on the back than the bird which ranges from the Ituri west to Nigeria."

Native name. *Ibebe* (Lutoro and Lukonjo).

Diet. Stomach held a chameleon (*C. b. ellioti*).

PHASIANIDAE

Francolinus sephaena rovuma Gray

Francolinus rovuma G. R. Gray, 1867, List Spec. Birds Brit. Mus., pt. 5, Gallinae, p. 52: Rovuma River.

♂ (M. C. Z. 270653) Mikindani, T. T. 15. iv. 39.
♂ (M. C. Z. 270654) Mbanja, T. T. 2. v. 39.

These almost topotypic birds possess conspicuous reddish brown shaft stripes over the entire under surface, in which respect they differ from *F. s. granti* of central Tanganyika Territory.

Francolinus hildebrandti grotei Reichenow

Francolinus grotei Reichenow, 1919, Journ. f. Orn., p. 334: Mikindani, Tanganyika Territory.

♂♂ (M. C. Z. 270655–6) Mikindani, T. T. 18. iv. 39.

Being topotypic of *grotei* we use that name tentatively, though this race was recently synonymized with the Zomba bird, *johnstoni*, of which we have no material, by Grant and Mackworth-Praed (1935, Ibis, p. 670).

Breeding. Attracted by its loud calling, I stalked one of these birds for a quarter of an hour, then shot it as it was fighting another cock.

Francolinus squamatus zappeyi Mearns

Francolinus schuetti zappeyi Mearns, 1911, Smiths. Misc. Coll., **56**, no. 20, p. 4: East shore of Lake Victoria.

♀ (M. C. Z. 270657) Nyakabande, U. 28. i. 39.

Breeding. This bird, together with her five eggs (preserved), was brought in by a native.

Pternistis afer melanogaster Neumann

Pternistes nudicollis melanogaster Neumann, 1898, Journ. f. Orn., **46**, p. 299, pl. iii, fig. 1: Tanga, Tanganyika Territory.

♂ (M. C. Z. 270658) Amboni Estate, T. T. 16. vi. 39.

This bird is topotypic. The birds from Lumbo, Mozambique, referred to *P. a. humboldtii* by Friedmann (1937, Bull, Mus. Comp. Zoöl., **81**, p. 60), have been examined by Grant and Mackworth-Praed

(1936, Bull. Brit. Orn. Club, **57**, pp. 43–4) and redetermined as *melanogaster*.

Native name. *Kwale* (Kisambara).

Diet. Stomach held *mtama* grain.

NUMIDIDAE

Numida meleagris mitrata Pallas

Numida mitrata Pallas, 1767, Spic. Zool., **1**, fasc. iv, p. 18, pl. iii: Madagascar.

♂ (M. C. Z. 270659) Mikindani, T. T. 18. iv. 39.

In life, crest yellow; line down nape black; crown, back of head, lores, and three spots below eye, red; behind eye and sides of neck pale blue; lappets blue, tipped with coral red; throat dark blue.

Guttera edouardi seth-smithi Neumann

Guttera cristata seth-smithi Neumann, 1908, Bull. Brit. Orn. Club, **23**, p. 13: Budongo Forest, Unyoro, Uganda.

♂♂ ♀ (M. C. Z. 270660–2) Kibale Forest, U. 16–17. xii. 38.

GRUIDAE

Balearica pavonina gibbericeps Reichenow

Balearica gibbericeps Reichenow, 1892, Journ. f. Orn., p. 126: Lake Jipe, near Kilimanjaro, Tanganyika Territory.

juv. ♀ (M. C. Z. 270663) Nyakabande, U. 27. i. 39.

Breeding. The above (pl. ii, fig. 1) was one of several nestlings offered for sale at Nyakabande. On February 3, at Mushongero, Lake Mutanda, a clutch of hard-set eggs (one preserved) were brought in by a native.

RALLIDAE

Limnocorax flavirostra (Swainson)

Gallinula flavirostra Swainson, 1837, Birds West Afr., **2**, p. 244, pl. xxviii: Senegal.

♂ (M. C. Z. 270664) Kitaya, T. T. 31. iii. 39.

Native names. *Nachindi* (Kiyao); *nantikinya* (Kimakonde).

Sarothrura pulchra centralis Neumann

Sarothrura pulchra centralis Neumann, 1908, Bull. Brit. Orn. Club, **21**, p. 45: Mswa, west shore of Lake Albert, Belgian Congo.

? ♂ (M. C. Z. 270665) Bundibugyo, U. 20. xii. 38.

Native name. *Mbulu* (Luamba).

CHARADRIIDAE

Charadrius alexandrinus tenellus Hartlaub

Charadrius tenellus Hartlaub, 1861, Fauna Madagascar, p. 72: Madagascar.

♀ (M. C. Z. 270666) Mikindani, T. T. 14. iv. 39.

Native name. *Limbapa* (Kimakonde).

Xiphidiopterus albiceps (Gould)

Vanellus albiceps Gould, 1834, Proc. Zool. Soc. London, p. 45: Quorra River (*i.e.* Niger) or Fernando Po.

♂ (M. C. Z. 270667) Kitaya, T. T. 31. iii. 39.

The white-headed plover is a western species, but has been recorded already from the Rufigi River, 200 miles north of the Rovuma where this was shot.

TRERONIDAE

Treron calva salvadorii (Dubois)

Vinago salvadorii Dubois, 1897, Proc. Zool. Soc. London, p. 784: Eastern and central tropical Africa. West shores of Lake Tanganyika (restricted Hartert and Goodson).

♂ ♀ (M. C. Z. 270668–9) Idjwi Id., B. C. 1. iii. 39.

These birds are more or less intermediate between *calva* and *salvadorii*, being yellower than the former yet not so yellow as the latter.

Native name. *Chokore* (Lulega).

Treron calva wakefieldii (Sharpe)

Vinago wakefieldii Sharpe, 1874, Proc. Zool. Soc. London for 1873, p. 715, pl. lviii, fig. 2: Mombasa, Kenya Colony.

♂ (M. C. Z. 270670) Amboni Estate, T. T. 24. vi. 39.

This seems best treated as a race of *calva* than as a separate species.

Native name. *Ninga* (Kisambara).

COLUMBIDAE

Columba arquatrix arquatrix Temminck

Columba arquatrix Temminck, 1809, Pigeons, Colombes, p. 11, pl. v: Anteniquoi country, *i.e.* Knysna district, Cape Province.

♀ (M. C. Z. 270671) Idjwi Id., B. C. 21. ii. 39.

Native name. *Shindamulala* (Lulega).

Streptopelia semitorquata semitorquata (Rüppell)

Columba semitorquata Rüppell, 1837, Neue Wirbelth., Vögel, p. 66, pl. xxiii, fig. 2: Taranta Mountains, Ethiopia.

♂ ♀ (M. C. Z. 270672–3) Mihunga Ridge, U. 11. i. 39.
♂ ♀ (M. C. Z. 270674–5) Nyakabande, U. 7. ii. 39.
♂ ♀ (M. C. Z. 270676–7) Idjwi Id., B. C. 21. ii. & 1. iii. 39.
♀ (M. C. Z. 270678) Kitaya, T. T. 30. iii. 39.
♂ ♂ ♀ (M. C. Z. 270679–81) Magrotto Mtn., T. T. 1. vii. 39.

Native names. *Dwa* (Lutoro); *kalikuku* (Lukonjo); *njuva* (Kiyao); *lideya* (Kimakonde); *hua* (Kisambara).

Breeding. On February 7, ova enlarged to 10 mm. diameter.

Streptopelia capicola somalica (Erlanger)

Turtur damarensis somalicus Erlanger, 1905, Journ. f. Orn., p. 127: Sarigo, southern Somaliland.

♀ (M. C. Z. 270682) Kitaya, T. T. 28. iii. 39.

This single specimen appears to agree better with *somalica* than with either *tropica* of nearby Songea, or *anceps* of Kilosa; in the absence of adequate series of all three, however, the determination need not be regarded as final. If correct, it involves a southward extension of range for *somalica* along the coast from Pangani River to the Rovuma River.

Native names. *Njuva jalusele* (Kiyao); *chimbelele* (Kimakonde).

Turtur chalcospilos chalcospilos (Wagler)

Columba chalcospilos Wagler, 1827, Syst. Av., Columba, sp. 82: "Terra Caffrorum," *i.e.* eastern Cape Province.

4 ♂ ♂ (M. C. Z. 270683–6) Kitaya, T. T. 27. iii-3. iv. 39.
♂ (M. C. Z. 270687) Mikindani, T. T. 17. iv. 39.
♂ (M. C. Z. 270688) Mbanja, T. T. 28. iv. 39.

Native names. *Kitukutuku* (Kiyao); *chindutu* (Kimakonde at Kitaya); *lidea* (Kimakonde at Mbanja).

Breeding. On March 30, at Kitaya, 2 eggs measuring 20 x 16 mm. were collected.

PSITTACIDAE

Psittacus erithacus erithacus Linnaeus

Psittacus erithacus Linnaeus, 1758, Syst. Nat. ed. 10, **1**, p. 99: Guinea.

♂ ♀ (M. C. Z. 270689–90) Idjwi Id., B. C. 1. iii. 39.

Native name. *Kasuku* (Lulega).

Poicephalus cryptoxanthus tanganyikae Bowen

Poicephalus fuscicapillus tanganyikae Bowen, 1930, Proc. Acad. Nat. Sci. Philadelphia, **82**, p. 267: Kilosa, Tanganyika Territory.

1 (M. C. Z. 270691) Kitaya, T. T. 25. iii. 39.
♂ ♀ (M. C. Z. 270692–3) Mikindani, T. T. 18. iv. 39.
♂ ♀ (M. C. Z. 270694–5) Mbanja, T. T. 24. vi. 39.

Wings measure: ♂♂ 147–149 mm., ♀ ♀ 139–141 mm.

Grant and Mackworth-Praed (1938, Bull. B. O. C., **59**, p. 27) sink *tanganidae* [*sic*] in the synonymy of *cryptoxanthus* after adding the wing length of a Tanganyika ♀ to the range of the Mozambique race. There appears to be a definite average size difference, however, which would justify retention of *tanganyikae*.

Native names. *Ngwesi* (Kiyao); *mwhendi* (Kimakonde at Kitaya); *ungudi* (Kimakonde at Mikindani).

MUSOPHAGIDAE

Tauraco schüttii emini (Reichenow)

Turacus emini Reichenow, 1893, Orn. Monatsb., p. 30: Bundeko, Semliki Valley, Belgian Congo.

♂ ♀ ♀ (M. C. Z. 270696–8) Budongo Forest, U. 2–3. xii. 38.

Musophaga violacea rossae Gould

Musophaga rossae Gould, 1851, Proc. Zool. Soc. London, p. 93: Western coast of Africa, *i.e.* Loanda, Angola (*fide* Grant, 1915, Ibis, p. 413).

3 ♂♂ 2 ♀ ♀ (M. C. Z. 270699–702) Idjwi Id., B. C. 18. ii-2. iii. 39.

Native name. *Nduku* (Lulega).

Corythaeola cristata (Vieillot)

Musophaga cristata Vieillot, 1816, Analyse, p. 68: Africa.

3 ♂♂ (M. C. Z. 270703–5) Mabira Forest, U. 12–15. xi. 38.
2 ♂♂ (M. C. Z. 270706–7) Budongo Forest, U. 1. xii. 38.
♂ (M. C. Z. 270708) Kibale Forest, U. 13. xii. 38.

CUCULIDAE

Cuculus clamosus clamosus Latham

Cuculus clamosus Latham, 1802, Genl. Syn., **2**, Suppl., p. xxx: Cape of Good Hope, *i.e.* Cradock Division, Cape Province.

3 ♂♂ 2 ♀♀ (M. C. Z. 270709–13) Kitaya, T. T. 25–28. iii. 39.
♀ (M. C. Z. 270714) Mbanja, T. T. 27. iv. 39.

Native names. *Nankoka* (Kiyao); *mpando* (Kimakonde).
Breeding. Of one ♂ a single testis only slightly enlarged.
Diet. One stomach held three black-and-yellow, spiny caterpillars.

Clamator cafer (Lichtenstein)

Cuculus cafer A. Lichtenstein, 1793, Cat. rer. rar. Hamb., p. 14: Kaffirland, *i.e.* eastern Cape Province.

♀ (M. C. Z. 270715) Kitaya, T. T. 27. iii. 39.

Native name. *Nankoka* (Kiyao, see above also); *nanchuwi* (Kimakonde).

Chrysococcyx klaas klaas (Stephens)

Cuculus klaas Stephens, 1815, in Shaw, Genl. Zool., **9**, p. 128: Platte River or Cape Province (*fide* Levaillant).

♂ (M. C. Z. 270716) Mihunga ridge, U. 19. i. 39.
♂ (M. C. Z. 270717) Kitaya, T. T. 25. iii. 39.
♂ (M. C. Z. 270718) Mikindani, T. T. 14. iv. 39.

Native names. *Nderemhi* (Lukonjo); *niwi* (Kimakonde).

Chrysococcyx caprius (Boddaert)

Cuculus caprius Boddaert, 1783, Tabl. Pl. Enlum, p. 40, no. 657: Cape of Good Hope.

1 ♂ 3 ♀♀ (M. C. Z. 270719–22) Kitaya, T. T. 30. iii. 39.

Ceuthmochares aereus intermedius Sharpe

Ceuthmochares intermedius Sharpe, 1884, Journ. Linn. Soc. London, Zool., **17**, p. 432: Semmio (*i.e.* Zémio), Niam-niam, Belgian Congo.

♂ (M. C. Z. 270723) Budongo Forest, U. 28. xi. 38.
♂ ♀ (M. C. Z. 270724–5) Idjwi Id., B. C. 27. ii. 39.

Wings of ♂ and ♀ from Idjwi measure 118–120 mm., tails 219–222 mm.

Native name. *Legashuku* (Lulega).

Centropus superciliosus loandae Grant

Centropus superciliosus loandae C. Grant, 1915, Bull. Brit. Orn. Club, **35**, p. 54: near Dalla Tando, Angola.

♀ (M. C. Z. 270726) Idjwi Id., B. C. 3. iii. 39.

Native name. *Chibilibili* (Lulega).

Centropus superciliosus burchellii Swainson

Centropus burchellii Swainson, 1837, Anim. Menag., p. 321: South Africa, *i.e.* Cape Province (ex Burchell).

♂ juv., ♀ (M. C. Z. 270727–8) Kitaya, T. T. 27. iii. 39.
♂ (M. C. Z. 270729) Mikindani, T. T. 18. iv. 39.
♂ (M. C. Z. 270730) Mbanja, T. T. 2. v. 39.
♂ (M. C. Z. 270731) Nchingidi, T. T. 10. v. 39.

The last two birds come from localities ten miles north and fifty miles southwest of Lindi and are therefore almost topotypic of *fasciipygialis* Reichenow (described from Lindi; Quilimane; Mozambique; etc.). They have also been compared with birds from Lumbo, Mozambique. We regard *fasciipygialis* as a synonym.

Native names. *Litipilipili* (Kiyao); *natipitela* (Kimakonde).

TYTONIDAE

Tyto alba affinis (Blyth)

Strix affinis Blyth, 1862, Ibis, p. 388: Cape of Good Hope.

♂ ♀ (M. C. Z. 270732–3) Nchingidi, T. T. 17. v. 39.

Diet. Stomach of each held a bird. According to their native captor, both these owls were taken from a hollow tree.

STRIGIDAE

Otus leucotis granti (Kollibay)

Pisorhina leucotis granti Kollibay, 1910, Orn. Monatsb., **18**, p. 148: Southwest Africa.

♂ (M. C. Z. 270734) Mbanja, T. T. 2. v. 39.

Diet. Stomach held a cricket and praying mantis. This owl flew into my bat net shortly after sunrise.

Bubo africanus africanus (Temminck)

Strix africana Temminck, 1823, Pl. Col., livr. 9, pl. 50: Cape of Good Hope.

♀ (M. C. Z. 270735) Magrotto Mtn., T. T. 6. vii. 39.

Native name. *Kungwi* (Kisambara).

Diet. Stomach held an adult house rat (*Rattus r. kijabius*) entire!

Ciccaba woodfordii nigricantior (Sharpe)

Syrnium nigricantius Sharpe, 1897, Bull. Brit. Orn. Club, **6**, p. xlvii: Mpwapwa, Tanganyika Territory.

♀ (M. C. Z. 270736) Amboni Estate, T. T. 21. vi. 39.

Diet. Stomach held an acridian, grasshopper, and praying mantis. I shot this owl at night in a tree at the forest edge, thereby disturbing a troupe of colobus monkeys who made off with loud cries.

CAPRIMULGIDAE

Scotornis fossii mossambicus (Peters)

Caprimulgus mossambicus Peters, 1868, Journ. f. Orn., **16**, p. 134: Inhambane, Mozambique.

♂ ♀ (M. C. Z. 270737–8) Kitaya, T. T. 3. iv. 39.

Native names. *Nalumbapala* (Kiyao); *nalumbao* (Kimakonde).

Macrodipteryx longipennis (Shaw)

Caprimulgus longipennis Shaw, 1796, Nat. Misc., **8**, p. 265: Sierra Leone.

♀ ♀ (M. C. Z. 270739–40) Butiaba Escarpment, U. 29. xi. 38.

A plume-bearing ♂ standard-winged nightjar was shot at the same time as the foregoing but was lost in long grass by the side of the road on which they were sitting at the summit of the escarpment.

COLIIDAE

Colius striatus mombassicus van Someren

Colius striatus mombassicus van Someren, 1919, Bull. Brit. Orn. Club, **40**, p. 26: Changamwe, Kenya Colony.

2 ♂♂ 2 ♀♀ (M. C. Z. 270741–44) Siga Caves, T. T. 10. vi. 39.)

These colies have whiter cheeks than those of our Morogoro material representing *affinis* Shelley.

Colius striatus kiwuensis Reichenow

Colius kiwuensis Reichenow, 1908, Orn. Monatsb., p. 191: Lake Kivu.

♂ ♂ (M. C. Z. 270745–6) Mihunga Ridge, U. 10. i. 39.
♂ ♀ (M. C. Z. 270747–8) Idjwi Id., B. C. 24. ii. 39.

The latter are topotypes, the former within the range of this race as defined by Chapin (1939, Bull. Am. Mus. Nat. Hist., **75**, p. 475).

Native names. *Msonono* (Lutoro); *msole* (Lukonjo); *kishule* (Lulega).

ALCEDINIDAE

Corythornis cristata cristata (Pallas)

Alcedo cristata Pallas, 1764, in Vroeg, Cat., Adumb., no. 55, pl. i: Cape of Good Hope.

♀ (M. C. Z. 270749) Mushongero, U. 3. ii. 39.

Taken late at night as it was roosting on a papyrus just above the water; paddling up in a dugout, I picked it off by hand.

Ispidina picta picta (Boddaert)

Todus pictus Boddaert, 1783, Tabl. Pl. Enlum., p. 49: "Juida," *i.e.* St. Louis, Senegal (*fide* Buffon, 1780, Oiseaux, **7**, p. 229).

♂ (M. C. Z. 270750) Budongo Forest, U. 29. xi. 38.

Ispidina picta natalensis (Smith)

Alcedo natalensis A. Smith, 1831, S. Afr. Quart. Journ. (1), no. v, p. 14: east of Cafferland, *i.e.* Natal.

♂ (M. C. Z. 270751) Magrotto Mtn., T. T. 3. vii. 39.

Native name. *Kumbulu* (Kisambara, but not specific).

Myioceyx lecontei ugandae van Someren

Myioceyx lecontei ugandae van Someren, 1921, Bull. Brit. Orn. Club, **41**, p. 105: Budongo Forest, Uganda.

♂ (M. C. Z. 270752) Budongo Forest, U. 1. xii. 39.

Breeding. Testes of this topotype very large.

Halcyon senegalensis cyanoleuca (Vieillot)

Alcedo cyanoleuca Vieillot, 1818, N. Dict. Hist. Nat., **19**, p. 401: Angola.

♂ ♀ ♀ (M. C. Z. 270753–5) Kitaya, T. T. 27-30. iii. 39.

Native names. Ngwilile (Kiyao); *cheleuli* (Kimakonde); but neither specific.

Halcyon albiventris orientalis Peters

Halcyon orientalis Peters, 1868, Journ. f. Orn., p. 134: Inhambane, Mozambique.

♂ ♀ (M. C. Z. 270756–7) Kitaya, T. T. 25 & 30. iii. 39.
♀ (M. C. Z. 270758) Mikindani, T. T. 10. iv. 39.
♂ (M. C. Z. 270759) Lindi, T. T. 2. vi. 39.
♂ (M. C. Z. 270760) Magrotto Mtn., T. T. 8. vii. 39.

Native names. Libwila (Kimakonde); *kumbulu* (Kisambara, but not specific).

Halcyon chelicuti chelicuti (Stanley)

Alcedo chelicuti Stanley, 1814, in Salt, Abyssinia, App., p. lvi: Chelicut, Ethiopia.

♂ ♀ ♀ (M. C. Z. 270761–63) Kitaya, T. T. 27–30. iii. 39.
♀ (M. C. Z. 270764) Mbanja, T. T. 27. iv. 39.
♂ (M. C. Z. 270765) Lindi, T. T. 31. v. 39.

Wings measure: ♂♂ 76.7–77.3 mm., ♀ ♀ 73.5–78.3 mm.

Native names. The same as for *H. s. cyanoleucus*, in both Kiyao and Kimakonde.

MEROPIDAE

Melittophagus pusillus meridionalis Sharpe

Melittophagus meridionalis Sharpe, 1892, Cat. Birds Brit. Mus., **17**, p. 45, pl. i, fig. 4: Pinetown, Natal (type in Brit. Mus.).

♂ ♀ ♀ (M. C. Z. 270766–8) Kitaya, T. T. 25–27. iii. 39.
♂ ♀ (M. C. Z. 270769–70) Mikindani, T. T. 19. iv. 39.
♂ ♀ ♀ ♀ (M. C. Z. 270771–74) Mbanja, T. T. 28. iv. 39.
♀ (M. C. Z. 270775) Lindi, T. T. 31. v. 39.

Several of these skins are indistinguishable from those of the north-eastern form *cyanostictus* (Cabanis).

Melittophagus lafresnayii oreobates Sharpe

Melittophagus oreobates Sharpe, 1892, Ibis, p. 320: Savé, Mt. Elgon, *i.e.* Sabei, northern slopes in Uganda (*fide* Loveridge, 1936).

♀ (M. C. Z. 270776) Mubuku Valley, U. 2. i. 39.

Native names. *Miyoro* (Lutoro); *musimambugu* (Lukonjo).
Breeding. A large egg forming.

BUCEROTIDAE

Bycanistes bucinator bucinator (Temminck)

Buceros bucinator Temminck, 1824, Pl. Col. livr. 48, pl. cclxxxiv: Cape of Good Hope.

♂ (M. C. Z. 270777) Nchingidi, T. T. 13. v. 39.

Bycanistes subcylindricus (Sclater)

Buceros subcylindricus P. L. Sclater, 1870, Proc. Zool. Soc. London, p. 668, pl. xxxix: West Africa.

♂ ♀ (M. C. Z. 270778–9) Mabira Forest, U. 16. xi. 38.
Skull of ♀ (M. C. Z.) Budongo Forest, U. 28. xi. 38.

Bycanistes cristatus brevis Friedmann

Bycanistes cristatus brevis Friedmann, 1929, Proc. N. Eng. Zoöl. Club, **11**, p. 32: Mt. Lutindi, Usambara Mountains, Tanganyika Territory.

♂ (M. C. Z. 270780) Siga Caves, T. T. 14. vi. 39.

Native name. *Hondo* (Kisambara).

Lophoceros melanoleucos suahelicus Neumann

Lophoceros melanoleucos suahelicus Neumann, 1905, Journ. f. Orn., p. 187: Morogoro, Tanganyika Territory.

♂♂ ♀ (M. C. Z. 270781–83) Mikindani, T. T. 12. iv. 39.
♂♂ ♀♀ (M. C. Z. 270784–7) Mbanja, T. T. 26–28. iv. 39.
♀ (M. C. Z. 270788) Siga Caves, T. T. 12. vi. 39.
♀ (M. C. Z. 270789) Amboni Estate, T. T. 26. vi. 39.

Native names. *Mwikwi* (Kimakonde, but not specific); *kwembe* (Kisambara).

Breeding. On June 26, ovules small.

Diet. Stomachs held: (1) Eight green caterpillars; (2) six green caterpillars; (3) many grasshoppers; (4) grasshopper legs and green stuff; (5) grasshoppers and peanuts; (6) snail and peanuts.

Lophoceros fasciatus (Shaw)

Buceros fasciatus Shaw, 1811, Genl. Zool., **8**, pt. i, p. 34: Angola.

♂ (M. C. Z. 270790) Budongo Forest, U. 3. xii. 38.

Lophoceros pallidirostris neumanni Reichenow

Lophoceros neumanni Reichenow, 1894, Orn. Monatsb., **2**, p. 50 (*nom. nud.*); id. Vögel D.-O. Afrikas, p. 128: Mgera, Tanganyika Territory.

♂ (M. C. Z. 270791) Kitaya, T. T. 25. iii. 39.

Native names. *Likwepe* (Kiyao); *mwikwi* (Kimakonde, but not specific).

CORACIIDAE

Coracias caudata caudata Linnaeus

Coracias caudata Linnaeus, 1766, Syst. Nat. ed. 12, **1**, p. 160: Angola.

♂ ♀ (M. C. Z. 270792–3) Kitaya, T. T. 27. iii. 39.

Native names. *Ngambwi* (Kiyao); *gambwila* (Kimakonde).

Eurystomus glaucurus (Müller)

Coracias glaucurus P. L. S. Müller, 1776, Syst. Nat. Suppl., p. 86: Madagascar.

♂ (M. C. Z. 270794) Nchingidi, T. T. 12. v. 39.

Eurystomus afer suahelicus Neumann

Eurystomus afer suahelicus Neumann, 1905, Journ. f. Orn., p. 186: "Tschara," *i.e.* Charra, Tana River, Kenya Colony.

♂ (M. C. Z. 270795) Kitaya, T. T. 25. iii. 39.

Native names. *Chole* (Kiyao); *diole* (Kimakonde).

Eurystomus gularis neglectus Neumann

Eurystomus gularis neglectus Neumann, 1908, Orn. Monatsb., **16**, p. 28: Canhoca, Angola.

♀ (M. C. Z. 270796) Kibale Forest, U. 10. xii. 38.

UPUPIDAE

Upupa africana Bechstein

Upupa africana Bechstein, 1811, Kurze Uebers., **4**, p. 172: Congo to the Cape

♂ (M. C. Z. 270797) Mbanja, T. T. 28. iv. 39.

PHOENICULIDAE

Phoeniculus purpureus marwitzi (Reichenow)

Irrisor erythrorhynchus marwitzi Reichenow, 1906, Orn. Monatsb., **16**, p. 171: Mkalama, Kondoa Irangi district, Tanganyika Territory.

4 ♂♂, 1 ♀ (M. C. Z. 270798–802) Mikindani, T. T. 15. iv. 39.
♂ (M. C. Z. 270803) Mbanja, T. T. 29. iv. 39.

Native name. *Yelowele* (Kimakonde).

Phoeniculus bollei jacksoni (Sharpe)

Irrisor jacksoni Sharpe, 1890, Ann. Mag. Nat. Hist. (6), **6**, p. 503: Kikuyu country, Kenya Colony.

3 ♂♂, 2 ♀♀ (M. C. Z. 270804–8) Idjwi Id., B. C. 27. ii. 39.

All these birds were shot from the same flock, and near the summit of the mountain; their wings measure: ♂♂ 127–136 mm., ♀♀ 121-131 mm. Thus they compare better with Chapin's (1939, Bull. Am. Mus. Nat. Hist., **75**, p. 327) measurements of 123–140 mm. for nineteen Congo birds of the montane form, rather than with those of the lowland race.

Rhinopomastus cyanomelas schalowi Neumann

Rhinopomastus schalowi Neumann, 1900, Journ. f. Orn., p. 221: Usandawi, Tanganyika Territory.

♂ ♀ ♀ (M. C. Z. 270809–11) Kitaya, T. T. 25 & 30. iii. 39.
♂ ♀ (M. C. Z. 270812–3) Mikindani, T. T. 17. iv. 39.
♂ (M. C. Z. 270814) Siga Caves, T. T. 8. vi. 39.

Native names. *Ligolegole* (Kiyao); *dolowele* (Kimakonde at Kitaya); *nandumbi* (Kimakonde at Mikindani).

CAPITONIDAE

Buccanodon leucotis kilimense (Shelley)

Smilorhis kilimensis Shelley, 1889, Ibis, p. 477: Kilimanjaro district, Tanganyika Territory.

♂ ♀ ♀ (M. C. Z. 270815–7) Magrotto Mtn., T. T. 30. vi. & 5. vii. 39.

Buccanodon olivaceum woodwardi (Shelley)

Stactolaema woodwardi Shelley, 1895, Bull. Brit. Orn. Club, **5**, p. iii: Zululand (type in Brit. Mus. from Echowe).

1 ♂ 6 ♀ ♀ (M. C. Z. 270818–24) Nchingidi, T. T. 10–12. v. 39.

These birds have been compared with topotypical *woodwardi*, loaned by the American Museum of Natural History. While they exhibit a slight tendency towards *olivaceum*, it is not sufficient to warrant naming. It is interesting to find *woodwardi* ranging so far north.

Pogoniulus leucolaima mfumbiri (Ogilvie-Grant)

Barbatula mfumbiri Ogilvie-Grant, 1907, Bull. Brit. Orn. Club, **19**, p. 107: Mfumbiro Volcano, Belgian Ruanda-Urundi.

♂ ♀ (M. C. Z. 270825–6) Mabira Forest, U. 8. xi. 38.
♀ ♀ (M. C. Z. 270827–8) Mihunga, U. 11 & 17. i. 39.

These birds are somewhat intermediate between *mfumbiri* and *nyanzae;* wings of ♀ ♀ 53–54.5 mm.

Native name. *Kaimbakilwa* (Lukonjo).

Pogoniulus bilineatus jacksoni (Sharpe)

Barbatula jacksoni Sharpe, 1897, Bull. Brit. Orn. Club, **7**, p. vii: Mau, Kenya Colony.

Barbatula kandti Reichenow, 1903, Orn. Monatsb., p. 23: Lake Kivu.

3 ♂♂ 2 ♀ ♀ (M. C. Z. 270829–32) Idjwi Id., B. C. 20–28. ii. 39.

A special effort was made, at the suggestion of Dr. Chapin, to secure this topotypic series of *kandti* — Kandt lived on Idjwi Id., in Lake Kivu, — with a view to settling the status of that form. Dr. Chapin

agrees that he sees no reason for its recognition and has himself (1939, Bull. Am. Mus. Nat. Hist., **75**, p. 503) followed Grant and Mackworth-Praed (1938, Bull. B. O. C., **58**, p. 82) in referring it to synonymy.

Native name. *Kigofe* (Lulega).

Pogoniulus bilineatus fischeri (Reichenow)

Barbatula fischeri Reichenow, 1880, Orn. Centralb., p. 181: No locality (Zanzibar, *vide* Journ. f. Orn., 1885, p. 125).

Pogoniulus bilineatus rovumensis Grote, 1935, Orn. Monatsb., **43**, p. 53: Mikindani, Tanganyika Territory.

♂ (M. C. Z. 270833) Kitaya, T. T. 28. iii. 39.

This bird, with a wing measurement of 51.25 mm., is practically topotypic of *rovumensis*, Kitaya being on the Rovuma River and only twenty miles south of Mikindani. We refer *rovumensis* to the synonymy of *fischeri*, the wings of our topotypical series of Zanzibar barbets being 47.25 to 51 mm.

INDICATORIDAE

Indicator indicator (Sparrman)

Cuculus indicator Sparrman, 1777, Phil. Trans., **67**, p. 43, pl. i: Great Fish River, near Somerset East, Cape Province.

♀ (M. C. Z. 270834) Mbanja, T. T. 1. v. 39.

Melignothes exilis exilis Cassin

Melignothes exilis Cassin, 1856, Proc. Acad. Nat. Sci. Philadelphia, p. 157: Moonda River, Gaboon.

♂ (M. C. Z. 270835) Idjwi Id., B. C. 20. ii. 39.

Wing 70 mm.

Native name. *Semanzuki* (Lulega).

PICIDAE

Campethera nubica scriptoricauda (Reichenow)

Dendromus scriptoricauda Reichenow, 1896, Orn. Monatsb., **4**, p. 131: Bumi, Tanganyika Territory.

♀ (M. C. Z. 270836) Kitaya, T. T. 30. iii. 39.

♂ (M. C. Z. 270837) Mikindani, T. T. 20. iv. 39.

Native name. *Nyenyena* (Kimakonde).

Campethera cailliautii cailliautii (Malherbe)

Chrysopicos cailliautii Malherbe, 1849, Rev. Mag. Zool., p. 540: Africa (Mombasa, *apud* C. Grant, 1915, Ibis, p. 454).

♂ (M. C. Z. 270838) Kitaya, T. T. 30. iii. 39.
♂ (M. C. Z. 270839) Nchingidi, T. T. 10. v. 39.

These have also been compared with Nyasaland *fülleborni*, kindly lent by Dr. Chapin, but the southern race is a much paler, less greenish, form than *cailliautii*.

Campethera abingoni suahelica (Reichenow)

Dendromus chrysurus suahelicus Reichenow, 1902, Vögel Afr., **2**, p. 175: Great Arusha, Tanganyika Territory.

♂ ♀ ♀ (M. C. Z. 270840–42) Kitaya, T. T. 30. iii. 39.

We tentatively retain this race, despite its recent synonymizing with the typical form by Grant and Mackworth-Praed (1939, Bull. B.O.C., **60**, p. 17) because our long series of skins from Tanganyika localities appear to be more definitely yellowish green above than do birds from Mt. Selinda, S. Rhodesia.

Native names. *Gongonda* (Kiyao); *ngongona* (Kimakonde).

Dendropicos fuscescens lepidus (Cabanis & Heine)

Ipoctonus lepidus Cabanis & Heine, 1863, Mus. Hein., **4**, pt. 2, p. 118: Ethiopia.

♀ (M. C. Z. 270843) Idjwi Id., B. C. 2. iii. 39.

Wing 79 mm.

Native name. *Gongoshera* (Lulega).

Dendropicos fuscescens hartlaubii Malherbe

Dendropicos hartlaubii Malherbe, 1849, Rev. Mag. Zool., p. 532: Zanzibar.

3 ♂♂ (M. C. Z. 270844–6) Kitaya, T. T. 27–30. iii. 39.

HIRUNDINIDAE

Hirundo smithii smithii Leach

Hirundo smithii Leach, App. to Tuckey, 1818, Voy. R. Zaire, p. 407: Chisalla Island, lower Congo, Belgian Congo.

♂ ♀ (M. C. Z. 270847–8) Kitaya, T. T. 27. iii. 39.

Native names. *Chivalevale* (Kiyao); *nanyanda* (Kimakonde).

Hirundo senegalensis senegalensis Linnaeus

Hirundo senegalensis Linnaeus, 1766, Syst. Nat. ed. 12, **1**, p. 345: Senegal.

♂ ♀ (M. C. Z. 270849–50) Mubuku Valley, U. 30. xii. 38.

Native name. *Ndambera* (Lukonjo, but not generic).
Breeding. These are fledglings.

Psalidoprocne holomelaena massaica Neumann

Psalidoprocne holomelaena massaica Neumann, 1904, Orn. Monatsb., p. 144: Kikuyu, Kenya Colony.

♂ (M. C. Z. 270851) Mubuku Valley, U. 2. i. 39.
♂♂ ♀♀ (M. C. Z. 270852–5) Mihunga, U. 11 & 18. i. 39.

Native names. *Ntai* (Lutoro); *ndambera* (Lukonjo, but not generic).

Psalidprocne petiti orientalis Reichenow

Psalidprocne orientalis Reichenow, 1889, Journ. f. Orn., p. 277: Lewa, Dodoma District, Tanganyika Territory.

♀ (M. C. Z. 270856) Nchingidi, T. T. 11. v. 39.

Wing 96 mm.; tail 72 mm. The small size of this bird, as compared with ♂♂ from Kilosa and Tukuyu with wings of 104 and 108 mm., may possibly be attributable to immaturity or sex.

CAMPEPHAGIDAE

Campephaga flava flava Vieillot

Campephaga flava Vieillot, 1817, Nouv. Dict. d'Hist. Nat., **10**, p. 49: Southern Africa (female).

♂ (M. C. Z. 270857) Idjwi Id., B. C. 27. ii. 39.
♀ (M. C. Z. 270858) Kitaya, T. T. 5. iv. 39.

Native names. *Kikuku* (Lulega); *naukahichi* (Kimakonde).

Coracina caesia pura (Sharpe)

Graucalus purus Sharpe, 1891, Ibis, p. 121: Mt. Elgon.

♀ (M. C. Z. 270859) Mubuku Valley, U. 4. i. 39.
♀ (M. C. Z. 270860) Mihunga Ridge, U. 16. i. 39.
♂ (M. C. Z. 270861) Magrotto Mtn., T. T. 10. vii. 39.

The male shows a tendency towards typical *caesia* of South Africa.

Native names. *Kaneju* (Lutoro); *kinibwe* (Lukonjo).

Breeding. In both females from the Ruwenzori Mountains the ova are greatly enlarged and an egg formed.

DICRURIDAE

Dicrurus adsimilis divaricatus (Lichtenstein)

Musicapa divaricata Lichtenstein, 1823, Verz. Doubl. Zool. Mus. Berlin, p. 52: Senegal.

♂♂ (M. C. Z. 270862–3) Kitaya, T. T. 25 & 27. iii. 39.
♂♂ ♀ (M. C. Z. 270864–6) Mikindani, T. T. 17. iv. 39.
♂♂ ♀♀ (M. C. Z. 270867–70) Mbanja, T. T. 29. iv. 39.

Native names. *Likwilili* (Kiyao); *hiuluwilu* (Kimakonde at Kitaya); *namba* (Kimakonde at Mikindani).

Dicrurus ludwigii ludwigii (Smith)

Edolius ludwigii A. Smith, 1834, S. Afr. Quart. Journ. (2), p. 144: Port Natal *i.e.* Durban, Natal.

♂ ♀ (M. C. Z. 270871–2) Nchingidi, T. T. 11–12. v. 39.
♂ (M. C. Z. 270873) Magrotto Mtn., T. T. 6. vii. 39.

Native name. *Mlamba* (Kisambara).

ORIOLIDAE

Oriolus monacha rolleti Salvadori

Oriolus rolleti Salvadori, 1864, Atti Soc. Italiana Sci. Nat. Milano, **7**, Riunione a Biella, p. 161: White Nile between Lat 4° and 5° N.

♂ (M. C. Z. 270874) Mabira Forest, U. 11. xi. 38.
4 ♂♂ (M. C. Z. 270875–6) Idjwi Id., B. C. 23–28. ii. 39.

Wings 124, 124.5, 130, 131, and 131 mm. respectively.

Native name. *Lushawlinga* (Lulega).

Breeding. On November 11, at Mubango, Mabira Forest, testes large.

Oriolus monacha kikuyuensis van Someren

Oriolus larvatus kikuyuensis van Someren, 1922, Nov. Zool., **29**, p. 127: Nairobi, Kenya Colony.

♂ (M. C. Z. 270877) Kitaya, T. T. 28. iii. 39.
♂ (M. C. Z. 270878) Mikindani, T. T. 14. iv. 39.

The Mikindani bird is moulting, but the wing of the Kitaya oriole is 133 mm., so they are referred tentatively to *kikuyuensis* rather than to *reichenowi*, which has been reported on the coast to the north.

Native names. *Likudo* (Kiyao); *likubwamhu* (Kimakonde at Kitaya); *liehendi* (Kimakonde at Mikindani).

Oriolus chlorocephalus Shelley

Oriolus chlorocephalus Shelley, 1896, Ibis, p. 183, pl. iv: Mt. Chiradzulu, Nyasaland.

♂♂ (M. C. Z. 270879–80) Nchingidi, T. T. 11–12. v. 39.

The finding of this beautiful oriole on the Rondo Plateau helps to bridge a gap in its spotty distribution.

PARIDAE

Parus funereus (Verreaux and Verreaux)

Melanoparus funereus J. & E. Verreaux, 1855, Journ. f. Orn., p. 104: Gaboon.

♂ ♀ (M. C. Z. 270881–2) Kibale Forest. U. 12. xii. 38.

Parus fasciiventer Reichenow

Parus fasciiventer Reichenow, 1893, Orn. Monatsb., **1**, p. 31: Ruwenzori Mtns.

♂ (M. C. Z. 270883) Mubuku Valley, U. 30. xii. 38.
♂ (M. C. Z. 270884) Mihunga Ridge, U. 10. i. 39.

Native name. *Kakomogoli* (Lukonjo).

Breeding. Of these topotypes, the December bird is a nestling; the January bird was bald when shot.

TIMALIIDAE

Turdoides plebeja kirki (Sharpe)

Crateropus kirki Sharpe, 1876, in Layard, Birds S. Africa, ed. 2, p. 213: Zambezi country (type in Brit. Mus. from Mazzaro).

♂ ♀ (M. C. Z. 270885–6) Kitaya, T. T. 30. iii. 39.

Native names. *Likusesi* (Kiyao); *yayaya* (Kimakonde).

Illadopsis pyrrhopterus (Reichenow & Neumann)

Callene pyrrhoptera Reichenow & Neumann, 1895, Orn. Monatsb., **3**, p. 75: Mau, Kenya Colony.

♂ (M. C. Z. 270887) Mihunga Ridge, U. 13. i. 39.

This species does not seem to have found its final systematic resting place. It was originally described in 1895 as a Callene and was still carried in this genus of Turdidae in Sharpe's Handlist. When Bannerman named the Timaline genus Pseudoalcippe in 1923, this was one of the species transferred to it. Sclater, in 1930, followed Bannerman in his treatment of *pyrrhopterus*, but van Someren, in 1932, disagreed, and insisted that the bird was an Illadopsis; Friedmann & Loveridge, 1937, still included it in Pseudoalcippe.

The chief characters separating Pseudoalcippe from Illadopsis are the more sharply defined color pattern, weaker feet and bill, and shorter rictal bristles of the former. *Pyrrhopterus* does not fit exactly into either, occupying a more or less intermediate position, but perhaps nearest to Illadopsis in respect to bill and rictal bristles; further study may result in the union of the two genera.

Native name. *Kiniva* (Lukonjo).

Macrosphenus flavicans hypochondriacus (Reichenow)

Rectirostrum hypochondriacum Reichenow, 1893, Orn. Monatsb., **1**, p. 32: Kinjawanga, near Beni, Belgian Congo.

♀ (M. C. Z. 270888) Budongo Forest, U. 2. xii. 38.

PYCNONOTIDAE

Pycnonotus tricolor minor Heuglin

Pycnonotus nigricans var. *minor* Heuglin, 1869, Orn. Nordost. Afr., **1**, p. 398: Bahr el Abiad, *i.e.* Upper White Nile, Anglo-Egyptian Sudan.

♂ (M. C. Z. 270889) Mabira Forest, U. 14. xi. 38.
2 ♂♂ (M. C. Z. 270890–1) Mihunga Ridge, U. 11–28. i. 39.
♂ (M. C. Z. 270892) Nyakabande, U. 28. i. 39.
♂♂ ♀ (M. C. Z. 270893–4) Idjwi Id., B. C. 17–20. ii. 39.

Wings of ♂♂, 89.5, 92, 93.5 and 93.5 mm., ♀ ♀, 93.5, 94 and 99 mm. It should be borne in mind that the sexing of these birds was done by a native, for, while apparently *minor*, two of the males (from

Mihunga and Idjwi) are slightly below the figures furnished by van Someren, viz. ♂♂, 93–99 mm., ♀♀, 88–94 mm.

Native names. Sosolyc (Luganda); *isole* (Lutoro and Lukonjo); *lusholea* (Lulega).

Breeding. On November 14, testes large.

Pycnonotus tricolor micrus Oberholser

Pycnonotus layardi micrus Oberholser, 1905, Proc. U. S. Nat. Mus., **28**, p. 891: Taveta, Kenya Colony.

♂ (M. C. Z. 270895) Kitaya, T. T. 25. iii. 39.
♂ (M. C. Z. 270896) Mbanja, T. T. 1. v. 39.
♀ (M. C. Z. 270897) Nchingidi, T. T. 10. v. 39.
♀ (M. C. Z. 270898) Magrotto Mtn., T. T. 4. vii. 39.

Wings of Kitaya ♂, 90 mm., but worn; Mbanja ♂ molting; Nchingidi ♀, 86 mm.; Magrotto ♀, 85 mm.

Native names. Lisolokoto (Kiyao); *namtindi* (Kimakonde); *choe* (Kisambara).

Atimastillus flavicollis pallidigula (Sharpe)

Xenocichla pallidigula Sharpe, 1897, Bull. Brit. Orn. Club, **7**, p. 7: Entebbe, Uganda.

♂ (M. C. Z. 270899) Idjwi Id., B. C. 3. iii. 39.

Native name. Kichwagashwaga (Lulega).

Phyllastrephus debilis debilis (Sclater)

Xenocichla debilis W. Sclater, 1899, Ibis, p. 284: Near Inhambane, Mozambique

♂ (M. C. Z. 270900) Nchingidi, T. T. 11. v. 39.

Phyllastrephus flavostriatus tenuirostris (Fischer & Reichenow)

Xenocichla tenuirostris Fischer & Reichenow, 1884, Journ. f. Orn., p. 262: Lindi, Tanganyika Territory.

♂♂ (M. C. Z. 270901–2) Nchingidi, T. T. 11. v. 39.
?♀ (M. C. Z. 270903) Magrotto Mtn., T. T. 12. vii. 39.

The Nchingidi males are almost topotypic, and Chapin, who has kindly examined them, thinks that the unsexed Magrotto bird — despite its smaller size, wing 82 mm. — should also be referred to *tenuirostris*. This race differs from the typical form in being somewhat lighter and more plainly marked with yellow below. The recently described race *vincenti* C. Grant (1940, Bull. Brit. Orn. Club, **60**, p. 62) from Namuli Mtns., and southern Nyasaland, is but slightly different.

Arizelocichla tephrolaema kikuyuensis (Sharpe)

Xenocichla kikuyuensis Sharpe, 1891, Ibis, p. 118: Kikuyu, Kenya Colony.

♂ ♀ ♀ (M. C. Z. 270904–6) Mubuku Valley, U. 30. xii. 38–5. i. 39.

Native name. *Kiwota* (Lutoro and Lukonjo).
Breeding. On January 2, 1 large egg forming.

Arizelocichla milanjensis striifacies (Reichenow & Neumann)

Xenocichla striifacies Reichenow & Neumann, 1895, Orn. Monatsb., **3**, p. 74, Marangu, Mt. Kilimanjaro, Tanganyika Territory.

♂ ♀ (M. C. Z. 270907–8) Magrotto Mtn., T. T. 29. vi. 39.

Native name. *Kojojo* (Kisambara).
Breeding. On June 29, a large ovule.

Arizelocichla masukuensis roehli (Reichenow)

Andropadus roehli Reichenow, 1905, Orn. Monatsb., **13**, p. 181: Mlalo, Usambara Mountains, Tanganyika Territory.

♀ (M. C. Z. 270909) Magrotto Mtn., T. T. 7. vii. 39.

Charitillas gracilis ugandae (van Someren)

Andropadus ugandae van Someren, 1915, Bull. Brit. Orn. Club, **35**, p. 127: Mabira Forest, Uganda.

♀ ♀ (M. C. Z. 270910–11) Budongo Forest, U. 1. xii. 38.

In the absence of adequate comparative material, we employ van Someren's name as being undoubtedly applicable, but without vouching for its distinctness from typical *gracilis* of Angola.

Stelgidocichla latirostris eugenia (Reichenow)

Andropadus eugenius Reichenow, 1892, Journ. f. Orn., p. 53: Bukoba, Tanganyika Territory.

3 ♂♂ 1 ♀ (M. C. Z. 270912–4) Idjwi Id., B. C. 20–21. ii. 39.

Native name. *Lugwate* (Lulega).

Eurillas virens holochlorus van Someren

Eurillas virens holochlorus van Someren, 1922, Nov. Zool., **29**, p. 189: Sezibwa, Uganda.

♂ (M. C. Z. 270915) Budongo Forest, U. 1. xii. 38.

Breeding. Grass in bill when shot.

Eurillas virens marwitzi (Reichenow)

Andropadus marwitzi Reichenow, 1895, Orn. Monatsb., **3**, p. 188: Marangu, Mt. Kilimanjaro, Tanganyika Territory.

♀ (M. C. Z. 270916) Nchingidi, T. T. 11. v. 39.
♀ (M. C. Z. 270917) Magrotto Mtn., T. T. 3. vii. 39.

Native name. *Kojojo* (Kisambara, but not generic).

TURDIDAE

Turdus libonyanus costae Rensch

Turdus libonyanus costae Rensch, 1923, Journ. f. Orn., p. 99: Magogoni, lower Ruvu River, Tanganyika Territory.

♂ (M. C. Z. 270918) Lindi, T. T. 31. v. 39.

Turdus olivaceus baraka (Sharpe)

Merula baraka Sharpe, 1903, Bull. Brit. Orn. Club, **14**, p. 19: Ruwenzori Mtns., Uganda.

♂ ♀ (M. C. Z. 270919–20) Mihunga Ridge, U. 10 & 12. i. 39.

Native names. *Kinyabutoke* (Lutoro); *mkuhe* (Lukonjo).
Breeding. On January 12, the female was feeding a fledgling.

Neocossyphus rufus arrhenii Lönnberg

Neocossyphus rufus arrhenii Lönnberg, 1917, Arkiv Zool., **10**, No. 24, p. 30: Beni, Semliki Valley, Belgian Congo.

♀ (M. C. Z. 270921) Budongo Forest, U. 24. xi. 38.

Saxicola torquata axillaris (Shelley)

Pratincola axillaris Shelley, 1884, Proc. Zool. Soc. London, p. 556: Mt. Kilimanjaro, 7000 feet, Tanganyika Territory.

juv. ♂ (M. C. Z. 270922) Mushongero, U. 3. ii. 39.
? ♂ (M. C. Z. 270923) Idjwi Id., B. C. 21. ii. 39.

Native names. *Fundi* (Lugezi); *kashaveye* (Lulega).

Erythropygia hartlaubi Reichenow

Erythropygia hartlaubi Reichenow, 1891, Journ. f. Orn., p. 63: Mutjora, Semliki Valley (?Mtsora of Stanley).

♂ (M. C. Z. 270924) Mihunga Ridge, U. 11. i. 39.

Native name. *Enumbi* (Lukonjo).

Pogonocichla stellata intensa Sharpe

Pogonocichla intensa Sharpe, 1901, Bull. Brit. Orn. Club, **11**, p. 67: Ntebi, *i.e.* Entebbe, Uganda.

Tarsiger ruwenzorii Ogilvie-Grant, 1906, Bull. Brit. Orn. Club, **19**, p. 33: Mubuku Valley, 7000 feet, Ruwenzori Mtns., Uganda.

♂♂ ♀♀ (M. C. Z. 270925–8) Mubuku Valley, U. 31. xii. 38 & 3. i. 39

These specimens are topotypical of *ruwenzorii*, but this name is currently synonymized with *intensa;* lacking topotypical material of the latter we are not able to express an opinion as to the correctness of this course. We can detect no essential differences between this series and two males from the forest along the Lulenga-Kivu Road, eastern Congo, on the one hand, and a male from Ruanda on the other.

Native name. *Nombi* (Lukonjo).

SYLVIIDAE

Sylvia borin (Boddaert)

Motacilla borin Boddaert, 1783, Table Pl. Enl., p. 35: France (*ex* Daubenton, Pl. Enl., p. 579, fig. 2).

♀ (M. C. Z. 270929) Mabira Forest, U. 12. xi. 38.

On migration.

Seicercus laetus (Sharpe)

Cryptolopha laeta Sharpe, 1902, Bull. Brit. Orn. Club, **13**, p. 9: Ruwenzori Mountains, Uganda.

♂♂ ♀♀ (M. C. Z. 270930–33) Mubuku Valley, U. 31. xii. 38–7. i. 39.

Native name. *Kaboliamaisu* (Lukonjo).

Apalis flavida neglecta (Alexander)

Chlorodyta neglecta Alexander, 1900, Bull. Brit. Orn. Club, **10**, p. 17: S. E. Africa (Type in Brit. Mus. from Zambezi River).

♂ ♀ (M. C. Z. 270934–5) Kitaya, T. T. 25 & 27. iii. 39.
♂ ♀ (M. C. Z. 270936–7) Nchingidi, T. T. 10. v. 39.

Native name. *Chitakaka* (Kimakonde).

Apalis binotata personata Sharpe

Apalis personata Sharpe, 1902, Bull. Brit. Orn. Club, **13**, p. 9: Ruwenzori Mountains, Uganda.

♀ (M. C. Z. 270938) Mihunga Ridge, U. 12. i. 39.

Native name. *Kasandangaleka* (Lukonjo).

Apalis eidos sp. nov.

4 ♂♂ 4 ♀♀ (M. C. Z. 270939–44) Idjwi Id., B. C. 17. ii-1. iii. 39.

Type. Museum of Comparative Zoölogy, No. 270942, an adult male from Upper Mulinga River, Idjwi Island, Lake Kivu, Belgian Congo, collected by Arthur Loveridge, February 28, 1939.

Description. Allied to *A. argenta* Moreau (1941, Bull. Brit. Orn. Club, **61**, No. 437, p. 47) from Kungwe Mountain, western Tanganyika Territory, but, according to Dr. Chapin, who has compared our birds with the type of *argenta*, specifically distinct.

It differs from *argenta* in lacking the narrow silver edges on the inner primaries; in having the upper parts, except the crown, with a distinct olive green wash; in having the underparts white, shading to pale gray on sides of breast and to greenish olive on the flanks; and the underwing-coverts pale yellowish.

Measurements. Wings of ♂♂, 46 (Type), 47.5, 48 and 48 mm.; of ♀♀, 44.5, 44.5, 46, and 46.5 mm. Tails of ♂♂, 47 (Type), 47, 48 mm. and one damaged; of ♀♀, 43, 45, 45.5 mm. and one damaged.

Remarks. A pair of these birds have been donated to the Congo Museum, Tervueren. For description of type locality see final report of this series.

Native name. *Kifusambiro* (Lulega).

Apalis ruwenzorii ruwenzorii Jackson

Apalis ruwenzorii Jackson, 1904, Bull. Brit. Orn. Club, **15**, p. 11: Ruwenzori Mountains, Uganda.

♂ (M. C. Z. 270945) Mubuku Valley, U. 31. xii. 38.

Native name. *Kaswebe* (Lukonjo).

Sylvietta whytii whytii (Shelley)

Sylviella [*sic*] *whytii* Shelley, 1894, Ibis, p. 13: Zomba, Nyasaland.

Sylviella whytei [*sic*] *pallidior* Grote, 1911. Orn. Monatsb., **19**, p. 163: Mikindani, Tanganyika Territory.

♂♂ ♀♀ (M. C. Z. 270946–9) Kitaya, T. T. 28. iii. & 3. iv. 39.

Kitaya is scarcely twenty miles south of the type locality of *pallidior;* unfortunately we have no topotypical *whytii* for comparison. Three of these birds were shot from one flock, yet two (♂ ♀) are darker and two (♂ ♀) are paler, the latter comparing well with birds from Dar es Salaam, while the darkest of the series are almost as dark as the race *jacksoni* from Kamasia, Kenya Colony.

Eremomela scotops occipitalis (Fischer & Reichenow)

Tricholais occipitalis Fischer & Reichenow, 1884, Journ. f. Orn., p. 181: Pangani River, Tanganyika Territory.

♂♂ ♀ (M. C. Z. 270951–53) Kitaya, T. T. 30. iii. 39.

Native name. *Jijiliwa* (Kimakonde).

Camaroptera brachyura littoralis Grote

Camaroptera pileata littoralis Grote, 1911, Orn. Monatsb., **19**, p. 163: Mikindani, Tanganyika Territory.

♂ (M. C. Z. 270950) Kitaya, T. T. 3. iv. 39.

In referring this almost topotypic bird to *littoralis*, we follow Friedmann (1937, Bull. Mus. Comp. Zoöl., **81**, p. 269) in using the name, for we lack good comparative material.

Native names. *Katinye* (Kiyao); *mdinye* (Kimakonde).

Camaroptera brevicaudata griseigula Sharpe

Camaroptera griseigula Sharpe, 1892, Ibis, p. 158: Voi River, Teita, Kenya Colony.

juv. ♀ (M. C. Z. 270954) Mabira Forest, U. 18. xi. 38.
♂♂ (M. C. Z. 270955–6) Idjwi Id., B. C. 17 & 24. ii. 39.

Native name. *Ogosashakwe* (Lulega).

Camaroptera superciliaris ugandae Clarke

Camaroptera superciliaris ugandae S. Clarke, 1914, Bull. Brit. Orn. Club, **33**, p. 136: Uganda.

♀ (M. C. Z. 270957) Mabira Forest, U. 15. xi. 38.
♀ (M. C. Z. 270958) Budongo Forest, U. 29. xi. 38.

Breeding. On November 15, in breeding condition.

Cisticola chiniana heterophrys Oberholser

Cisticola heterophrys Oberholser, 1906, Ann. Carnegie Mus., **3**, p. 496: Mombasa, Kenya Colony.

♂ ♀ (M. C. Z. 270959–60) Magrotto Mtn., T. T. 3 & 5. vii. 39.

Recently recorded by Sclater & Moreau (1933, Ibis, p. 28) from the nearby Usambara Mountains.

Native name. *Mkueha* (Kisambara, but not specific).

Cisticola chubbi Sharpe

Cisticola chubbi Sharpe, 1892, Ibis, p. 157: Kimangitchi, Mt. Elgon.

♂♂ ♀ (M. C. Z. 270961–3) Mihunga Ridge, U. 12 & 18. i. 39.

Cisticola erythrops sylvia Reichenow

Cisticola sylvia Reichenow, 1904, Orn. Monatsb., p. 28: Ulegga, *i.e.* Warega, near Lake Albert.

♀ (M. C. Z. 270964) Idjwi Id., B. C. 3. iii. 39.

Native name. *Kifusambilo* (Lulega).

Cisticola erythrops nyasa Lynes

Cisticola erythrops nyasa Lynes, 1931, Ibis, p. 374: Chiromo, Ruo district, Nyasaland.

♂ (M. C. Z. 270965) Kitaya, T. T. 3. iv. 39.

Native names. *Lichonja* (Kiyao); *ndumbwi* (Kimakonde).

Prinia mistacea immutabilis van Someren

Prinia mistacea immutabilis van Someren, 1920, Bull. Brit. Orn. Club, **40**, p. 93: Lake Nakuru, Kenya Colony.

♂ (M. C. Z. 270966) Mabira Forest, U. 8. xi. 38.
♂ ♀ (M. C. Z. 270967–8) Budongo Forest, U. 2-3. xii. 38.
♂ (M. C. Z. 270969) Bundibugyo, U. 20. xii. 38.

Native names. *Ndiabununu* (Lutoro); *sesi* (Luamba).

Prinia mistacea tenella (Cabanis)

Drymoica tenella Cabanis, 1869, in von der Decken, Reise, **3**, p. 23: Mombasa, Kenya Colony.

♂ ♂ ♀ ♀ (M. C. Z. 270970–73) Kitaya, T. T. 25. iii.-3. iv. 39.
♂ (M. C. Z. 270974) Mikindani, T. T. 19. iv. 39.
♂ ♀ (M. C. Z. 270975–6) Mbanja, T. T. 26. iv. 39.
♂ (M. C. Z. 270977) Nchingidi, T. T. 10. v. 39.
♀ ♀ (M. C. Z. 270978–9) Lindi, T. T. 31. v. 39.
♂ (M. C. Z. 270980) Siga Caves, T. T. 15. vi. 39.
♂ (M. C. Z. 270981) Magrotto Mtn., T. T. 13. vii. 39.

The Lindi bird's tail was in process of moulting when shot.

Native names. *Kandidi* (Kiyao); *mchapi* (Kimakonde); *mkucha* (Kisambara, but not generic).

Prinia leucopogon reichenowi (Hartlaub)

Burnesia reichenowi Hartlaub, 1890, Journ. f. Orn., p. 151: Njangalo, north-eastern Belgian Congo.

♂ (M. C. Z. 270982) Mihunga Ridge, U. 12. i. 39.

MUSCICAPIDAE

Alseonax minimus pumilus Reichenow

Alseonax pumila Reichenow, 1892, Journ. f. Orn., pp. 32, 218: Bukoba, Tanganyika Territory.

♂ (M. C. Z. 270983) Mabira Forest, U. 15. xi. 38.
♀ (M. C. Z. 270984) Mubuku Valley, U. 3. i. 39.

Native name. *Ndonairi* (Lukonjo).

Alseonax minimus subtilis Grote

Alseonax murinus subtilus Grote, 1920, Orn. Monatsb., **28**, p. 114: Beni, Belgian Congo.

2 ♂♂, 3 ♀ ♀ (M. C. Z. 270985–8) Idjwi Id., B. C. 1. iii. 39.

Native name. *Torotonzi* (Lulega).

Alseonax aquaticus ruandae Gyldenstolpe

Alseonax infulatus ruandae Gyldenstolpe, 1922, Bull. Brit. Orn. Club, **43**, p. 36: Bufundi, Kigezi district, Uganda.

♂ ♀ (M. C. Z. 270989–90) Mushongero, U. 1. ii. 39.

Native name. *Kasindikera* (Lugezi).
Breeding. Another of these birds was observed building.

Alseonax flavipes Bates

Alseonax flavipes Bates, 1911, Ibis, p. 522: Camma River, Gaboon.
Pedilorhynchus epulatus sethsmithi van Someren, 1922, Nov. Zool., **29**, p. 96: Budongo Forest, Uganda.

♀ (M. C. Z. 270991) Budongo Forest, U. 25. xi. 38.

A topotype of *sethsmithi*.

Bradornis pallidus murinus Hartlaub & Finsch

Bradyornis [*sic*] *murinus* Hartlaub & Finsch, in Finsch & Hartlaub, 1870, Vögel Ost-Afr., Nachtr. p. 866: Caconda, Angola.

♀ ♀ (M. C. Z. 270992–93) Mbanja, T. T. 26. iv. & 3. v. 39.

Dioptrornis toroensis (Hartert)

Muscicapa toroensis Hartert, 1900, Novit. Zool., **7**, p. 37: Fort Gerry, *i.e.* Fort Portal, Uganda.

♂ (M.C.Z. 270994) Mihunga Ridge, U. 12. i. 39.
♀ (M.C.Z. 270995) Idjwi Id., B. C. 18. ii. 39.

Native names. Kinwa (Lukonjo); *shanshaluke* (Lulega).

Melaenornis pammelaina tropicalis (Cabanis)

Melanopepla tropicalis Cabanis, 1884, Journ. f. Orn., p. 241: Ikanga, Ukamba, Kenya Colony.

♀ ♀ (M. C. Z. 270996–7) Kitaya, T. T. 25. iii. 39.
♀ ♀ (M. C. Z. 270998–9) Mikindani, T. T. 15. iv. 39.
♀ (M. C. Z. 270000) Lindi, T. T. 31. v. 39.

The wings of these five females range from 96.5 to 99 mm., thus agreeing with Friedmann's (1937, U. S. Nat. Mus., Bull. 153, p. 233) findings that the northern race extends southwards to central Mozambique.

Native names. Namba (Kiyao and Kimakonde at Kitaya); *liuluwilu* (Kimakonde at Mikindani).

Megabyas flammulatus aequatorialis Jackson

Megabias [*sic*] *aequatorialis* Jackson, 1904, Bull. Brit. Orn. Club, **15**, p. 11: Entebbe, Uganda.

♂ (M. C. Z. 271001) Kibale Forest, U. 13. xii. 38.

Bias musicus changamwensis van Someren

Bias musicus changamwensis van Someren, 1919, Bull. Brit. Orn. Club, **40**, p. 24: Changamwe, near Mombasa, Kenya Colony.

♀ (M. C. Z. 271002) Kitaya, T. T. 3. iv. 39.
♂ (M. C. Z. 271003) Mikindani, T. T. 17. iv. 39.

This appears to be a somewhat doubtful form, our single female is perhaps, slightly paler than a topotypical *feminina*.

Native name. Nandiendiende (Kimakonde at Mikindani).

Batis reichenowi Grote

Batis reichenowi Grote, 1911, Orn. Monatsb., **19**, p. 162: Mikindani, Tanganzika Territory.

♀ (M. C. Z. 271004) Nchingidi, T. T. 11. v. 39.

Rondo Plateau, where this bird was shot, is almost due west of the type locality. Dr. Chapin concurs in the identification, pointing out that it differs only from the colored plate (1912, Journ. f. Orn., pl. viii) of *reichenowi* in the figured type having a little rufous mixed with the gray chest band as well as on the flanks.

Batis mixta (Shelley)

Pachyprora mixta Shelley, 1889, Proc. Zool. Soc. London, p. 359, pl. xl: Mt. Kilimanjaro, 6000–7000 feet, Tanganyika Territory.

♂ ♀ (M. C. Z. 271005–6) Magrotto Mtn., T. T. 8. vii. 39.

Native name. *Kikoda* (Kisambara).

Batis molitor soror Reichenow

Batis puella soror Reichenow, 1903, Vögel Afr., **2**, p. 485: Quilimane, Mozambique.

♀ (M. C. Z. 271007) Kitaya, T. T. 30. iii. 39.
♂♂ ♀♀ (M. C. Z. 271008–11) Mbanja, T. T. 27. iv. 39.
♀ (M. C. Z. 271012) Nchingidi, T. T. 10. v. 39.

Native names. *Galokototo* (Kiyao); *chikakodongo* (Kimakonde).

Batis minor nyansae Neumann

Batis minor nyansae Neumann, 1907, Journ. f. Orn., p. 354: Kiva Mtesa, Uganda.

♂ (M. C. Z. 271013) Mihunga Ridge, U. 12. i. 39.

Native names. *Narukaka* (Lutoro); *kasaramaganda* (Lukonjo).

Platysteira peltata peltata Sundevall

Platysteira peltata Sundevall, 1850, Oefv. Vet.-Ak. Förh., **7**, p. 105: "Caffraria Inferiore," *i.e.* Natal.

? ♀ (M. C. Z. 271014) Kitaya, T. T. 29. iii. 39.

Native names. *Namoto* (Kiyao); *mkwidimbuladingope* (Kimakonde).

Platysteira cyanea nyansae Neumann

Platysteira cyanea nyansae Neumann, 1905, Journ. f. Orn., p. 210: Bukoba, Tanganyika Territory.

♀ (M. C. Z. 271015) Idjwi Id., B. C. 2. iii. 39.

Native name. *Yongoyongo* (Lulega).

Erythrocercus livingstonei thomsoni Shelley

Erythrocercus thomsoni Shelley, 1882, Proc. Zool. Soc. London, p. 303, pl. xvi, fig. 2: Rovuma River.

♂ (M. C. Z. 271016) Nchingidi, T. T. 10. v. 39.

We are indebted to Dr. Chapin for the identification of this bird. He points out that Vincent found intermediates between *livingstonei* Gray of the Zambezi, and *thomsoni* Shelley of the Rovuma, in northern Mozambique, *viz. monapo* Vincent (1933, Bull. Brit. Orn. Club, **53**, p. 137), later (1934, Ibis, pp. 390–3, pl. xiv) discussing and figuring it. He considers the genus Chloropetella inseparable from Erythrocercus.

Erranornis longicauda teresita (Antinori)

Elminia teresita Antinori, 1864, Cat. Uccelli, p. 50: Djur, Bahr el Ghazal, Anglo-Egyptian Sudan.

♀ (M. C. Z. 271017) Mihunga Ridge, T. T. 14. i. 39.

Native name. *Kasanzamatekere* (Lukonjo).

Trochocercus albonotatus albonotatus Sharpe

Trochocercus albonotatus Sharpe, 1891, Ibis, p. 121: Mt. Elgon.

♂ ♀ ♀ (M. C. Z. 271018–20) Mubuku Valley, U. 30–31. xii. 38.

Native name. *Kasibiraho* (Lukonjo).

MOTACILLIDAE

Motacilla aguimp vidua Sundevall

Motacilla vidua Sundevall, 1850, Oefv. Vet.-Ak. Förh., **7**, p. 128: (Type in Stockholm Museum from Syene, *i.e.* Assouan, Upper Egypt).

♂ ♂ ♀ (M. C. Z. 271021–22) Mushongero, U. 1. ii. 39.

One male is in juvenile plumage, the three birds were a family party.
Native name. *Nyamanza* (Lugezi, but not specific).

Motacilla clara Sharpe

Motacilla clara Sharpe, 1908, Ibis, p. 341: *nom. nov. pro. M. longicauda* Rüppell (not Gmelin), 1840, Neue Wirbelth., p. 84, pl. xxix, fig. 2: Simen, Ethiopia.

♀ (M. C. Z. 271023) Magrotto Mtn., T. T. 5. vii. 39.

Native name. *Kiwiwimazi* (Kisambara).

Motacilla capensis wellsi Ogilvie-Grant

Motacilla wellsi Ogilvie-Grant, 1911, Bull. Brit. Orn. Club, **29**, p. 30: Kigezi, S. W. Uganda.

♂ (M. C. Z. 271024) Mushongero, U. 1. ii. 39.

This bird is topotypic, Mushongero being on Lake Mutanda, Kigezi. Its Lugezi name is the same as that for *vidua*, given above.

Budytes flavus thunbergi (Billberg)

Motacilla thunbergi Billberg, 1828, Syn. Faun. Scand., **1**, pt. 2, Aves, p. 50: Lapland.

♂ ♀ (M. C. Z. 271025–6) Budongo Forest, U. 1. xii. 38.
♂ (M. C. Z. 271027) Mushongero, U. 3. ii. 39.

Both Budongo migrants were sexed as female by the native skinner, one, however, appears to be a male.
Native name. *Nyamonyo* (Lugezi).

Anthus sordidus nyassae Neumann

Anthus nicholsoni nyassae Neumann, 1906, Journ. f. Orn., p. 233: between Sangesi and Songea, Tanganyika Territory.

3 ♂♂ 2 ♀♀ (M. C. Z. 271028–32) Mbanja, T. T. 26–27. iv. 39.

Macronyx sharpei Jackson

Macronyx sharpei Jackson, 1904, Bull. Brit. Orn. Club, **14**, p. 74: Mau Plateau, Kenya Colony.

♀ (M. C. Z. 271033) S. Kinangop, K. C. 28. x. 38.

This, the only Kenya bird in the collection, was non-breeding. We are indebted to Sir Charles Belcher for it.

LANIIDAE

Lanius mackinnoni Sharpe

Lanius mackinnoni Sharpe, 1891, Ibis, pp. 444, 596, pl. xiii: Kikuyu, Kenya Colony.

♂ juv. ♂ (M. C. Z. 271034–5) Mihunga Ridge, U. 11 & 17. i. 39.

Native names. *Nyarukaka* (Lutoro); *erisibi* (Lukonjo).

Lanius collurio collurio Linnaeus

Lanius collurio Linnaeus, 1758, Syst. Nat. ed. 10, **1**, p. 94: Europe (Sweden, restricted by Hartert, 1907, Vög. pal. Fauna, **1**, p. 439).

♀ (M. C. Z. 271036) Kitaya, T. T. 29. iii. 39.

Native name. *Namileu* (Kimakonde).

Laniarius ferrugineus major (Hartlaub)

Telephonus major Hartlaub, 1848, Rev. Zool., p. 108: Elmina, Gold Coast.

♂ (M. C. Z. 271037) Mushongero, U. 1. ii. 39.

Native name. *Nsetcherezi* (Lugezi).

Laniarius ferrugineus mossambicus (Reichenow)

Dryoscopus major mossambicus Reichenow, 1880, Journ. f. Orn., p. 141: Mozambique.

♀ (M. C. Z. 271038) Kitaya, T. T. 25. iii. 39.
♂ 3 ♀ ♀ (M. C. Z. 271039–42) Mikindani, T. T. 17. iv. 39.
♂ (M. C. Z. 271043) Nchingidi, I. T. 11. v. 39.

Native names. *Lijaka* (Kiyao); *namgoti* or *nangoti* (Kimakonde at Kitaya and Mikindani respectively).

Laniarius lühderi lühderi (Reichenow)

Dryoscopus lühderi Reichenow, 1874, Journ. f. Orn., p. 101: Cameroon.

4 ♂♂ 1 ♀ (M. C. Z. 271044–7) Idjwi Id., B. C. 20. ii-1. iii. 39.

Wings of ♂♂, 85.5, 86, 88 and 89.5 mm., of ♀, 80 mm. As the males have the measurements of the nominate form, the female is referred to it also.

Native name. *Ijongo* (Lulega).

Dryoscopus cubla hamatus Hartlaub

Dryoscopus hamatus Hartlaub, 1863, Proc. Zool. Soc. London, p. 106: Kazeh, *i.e.* Tabora, Unyamwezi, Tanganyika Territory.

♂ ♀ (M. C. Z. 271048–9) Kitaya, T. T. 29–30. iii. 39.
♀ (M. C. Z. 271050) Mikindani, T. T. 18. iv. 39.
♂ (M. C. Z. 271051) Mbanja, T. T. 27. iv. 39.
♂ (M. C. Z. 271052) Lindi, T. T. 31. v. 39.

Native names. *Lichau* (Kiyao); *mtiku* (Kimakonde at Kitaya); *lingoti* (Kimakonde at Mikindani).

Dryoscopus gambensis erwini Sassi

Dryoscopus gambensis erwini Sassi, 1923, Orn. Monatsb., **31**, p. 109: Forest west of Lake Tanganyika, Belgian Congo.

♂ (M. C. Z. 271053) Mihunga Ridge, U. 18. i. 39.

Tschagra australis congener (Reichenow)

Pomatorhynchus australis congener Reichenow, 1902, p. 258: (Type in Berlin Museum from Neu Helgoland, Songea district, Tanganyika Territory).

♂ (M. C. Z. 271054) Kitaya, T. T. 28. iii. 39.
♂ (M. C. Z. 271055) Mbanja, T. T. 3. v. 39.
♂ (M. C. Z. 271056) Nchingidi, T. T. 10. v. 39.

Native names. *Kaviko* (Kiyao); *nankambawla* (Kimakonde).

Tschagra australis littoralis (van Someren)

Harpolestes australis littoralis van Someren, 1921, Bull. Brit. Orn. Club, **41**, p. 102: Changamwe, Kenya Colony.

♂ (M. C. Z. 271057) Magrotto Mtn., T. T. 7. vii. 39.

Native name. *Kishimdemlima* (Kisambara).

Tschagra senegala mozambica (van Someren)

Harpolestes senegalus mozambicus van Someren, 1921, Bull. Brit. Orn. Club, **41**, p. 103: Lumbo, Mozambique.

♂ ♀ (M. C. Z. 271058–9) Kitaya, T. T. 30. iii. 39.
♂ (M. C. Z. 271060) Mbanja, T. T. 3. v. 39.

These are somewhat intermediate between *mozambica* and *orientalis* (Cabanis), but a trifle nearer the former.

Native names. Not differentiated from those of the last species.

ANTICHROMUS ANCHIETAE REICHENOWI (Neumann)

Telephonus reichenowi Neumann, 1900, Journ. f. Orn., p. 120: Tanganyika Territory.

♂ (M. C. Z. 271061) Magrotto Mtn., T. T. 5. vii. 39.

This appears to be a perfectly good race as defined in Reichenow's synopsis of the species as evidenced by our reasonably good series of the three forms.

Native name. Kishimdemlima (Kisambara, but not generic; see above).

NICATOR CHLORIS CHLORIS (Valenciennes)

Lanius chloris Valenciennes, 1826, Dict. Sci. Nat., **40**, p. 226: Galam, Senegal.

♂♂ (M. C. Z. 271062–3) Budongo Forest, U. 25. xi & 1. xii. 38.

STURNIDAE

CINNYRICINCLUS LEUCOGASTER VERREAUXI (Finsch & Hartlaub)

Pholidauges verreauxi "Bocage in litt.", 1870, Finsch & Hartlaub, Vögel Ost-Afr., p. 867: Caconda, Angola.

♂ juv., ♀ (M. C. Z. 271064–5) Kitaya, T. T. 3. iv. 39.

Native names. Litimbilwa (Kiyao); *namitema* (Kimakonde).

LAMPROCOLIUS CHALYBEUS SYCOBIUS Hartlaub

Lamprocolius sycobius Hartlaub, 1859, Journ. f. Orn., p. 19: Tete, Mozambique.

♀ (M. C. Z. 271066) Mikindani, T. T. 14. iv. 39.

LAMPROCOLIUS SPLENDIDUS SPLENDIDUS (Vieillot)

Turdus splendidus Vieillot, 1822, Enc. Méth., **2**, p. 653: Malimba, French Congo.

♀ ♀ (M. C. Z. 271067–8) Kibale Forest, U. 12. xii. 39.

ONYCHOGNATHUS TENUIROSTRIS (Rüppell)

Lamprotornis tenuirostris Ruppell, 1836, Neue Wirbelth., Vögel, p. 26, pl. x, fig. 1: Ethiopia.

♂♂ ♀ (M. C. Z. 271069–71) Idjwi Id., B. C. 2. iii. 39.

Native name. Kalungu (Lulega).

NECTARINIIDAE

Nectarinia kilimensis kilimensis Shelley

Nectarinia kilimensis Shelley, 1884, Proc. Zool. Soc. London, p. 555: Mt. Kilimanjaro, *circa* 5000 feet, Tanganyika Territory.

4 ♂♂ 1 ♀ (M. C. Z. 271072–76) Mihunga Ridge, U. 18–19. i. 39.
2 ♂♂ 1 ♀ (M. C. Z. 271077–8) Idjwi Id., B. C. 24–27. ii & 1. iii. 39.

Native names. Nswebe (Lukonjo); *mononi* (Lulega); *msozi* (Kisambara). In every case these names apply to all species of sunbirds.

Nectarinia purpureiventris (Reichenow)

Cinnyris purpureiventris Reichenow, 1893, Orn. Monatsb., **1**, p. 61: Migere, S. of Lake Edward, Kivu district.

♂♂ (M. C. Z. 271079–80) Mihunga Ridge, U. 11 & 18. i. 39.

Nectarinia erythrocerca erythrocerca Hartlaub

Nectarinia erythrocerca Hartlaub, 1857, Syst. Orn. Westafr., p. 270: No locality (White Nile, S. of 8° N., *fide* Heuglin, 1856).

♂ (M. C. Z. 271081) Mushongero, U. 3. ii. 39.

Cinnyris cupreus cupreus (Shaw)

Certhia cuprea Shaw, 1811, Gen. Zool., **8**, p. 201: Malimba, French Congo.

♂ (M. C. Z. 271082) Budongo Forest, U. 1. xii. 38.
♂ (M. C. Z. 271083) Idjwi Id., B. C. 3. iii. 39.

Cinnyris bifasciatus microrhynchus Shelley

Cinnyris microrhynchus Shelley, 1876, Monogr. Nectarin., p. 219, pl. lxvii: (Type in Brit. Mus. from Dar es Salaam, T. T.).

♂ (M. C. Z. 271084) Lindi, T. T. 31. v. 39.
♂ (M. C. Z. 271085) Amboni Estate, T. T. 24. vi. 39.

Cinnyris venustus igneiventris Reichenow

Cinnyris igneiventris Reichenow, 1899, Orn. Monatsb., **7**, p. 171: Karagwe, Uganda.

♂ (M. C. Z. 271086) Mubuku Valley, U. 7. i. 39.
4 ♂♂ (M. C. Z. 271087–90) Mihunga Ridge, U. 12–18. i. 39.
2 ♂♂ (M. C. Z. 271091) Idjwi Id., B. C. 17–23. ii. 39.

Cinnyris reichenowi reichenowi Sharpe

Cinnyris reichenowi Sharpe, 1891, Ibis, p. 444: Sotik, Kenya Colony.

5 ♂♂ 3 ♀♀ (M. C. Z. 271092–99) Mihunga Ridge, U. 11–19. i. 39.
8 ♂♂ 2 ♀♀ (M. C. Z. 271100–107) Idjwi Id., B. C. 18. ii-l. iii. 39.

Cinnyris chloropygius orphogaster Reichenow

Cinnyris chloropygius orphogaster Reichenow, 1899, Orn. Monatsb., **7**, p. 169: Central Africa (Type in Berlin Mus. from Bukoba, Tanganyika Territory).

4 ♂♂ 1 ♀ (M. C. Z. 271108–12) Budongo Forest, U. 24. xi–6. xii. 38.

Wings of ♂♂, 51, 52, 53, and an immature ♂, 47 mm.; of ♀, 53 mm.

Chalcomitra angolensis angolensis (Lesson)

Cinnyris angolensis Lesson, 1830, Traité d'Orn., p. 295: coast of Angola (Malimba, French Congo, fide Shelley, 1900, Birds Afr., **2**, p. 112).

♂ (M. C. Z. 271113) Mabira Forest, U. 8. xi. 38.

Chalcomitra senegalensis aequatorialis (Reichenow)

Cinnyris aequatorialis Reichenow, 1899, Orn. Monatsb., **7**, p. 171: Bukoba, Tanganyika Territory.

♀ (M. C. Z. 271114) Mabira Forest, U. 8. xi. 38.

Native name. *Kanunansubi* (Luganda).

Breeding. Netted on nest, which, with the eggs is preserved. The nest was attached to the end of a twig of a rose-apple tree (*Egernia jambos* — Myrtaceae) about ten feet from the ground. The nest is constructed of vegetable fibres, stripped bark, grass and a little lichen, lined internally with vegetable floss; it measures 200 mm. in length, by about 60 mm. in breadth. The clutch consisted of two fresh eggs, of which the ground color of one was whitish, of the other pale green, both streaked with dark purplish brown spots with smudged outlines, measuring 20.5 x 13 mm., and 21 x 13 mm. respectively.

Chalcomitra senegalensis inaestimata (Hartert)

Cinnyris gutturalis inaestimata Hartert, 1899, in Ansorge, Under the African Sun, App., p. 351: East Africa (Type in the American Mus. from Dar es Salaam).

4 ♂♂ 2 ♀♀ (M. C. Z. 271115–20) Mikindani, T. T. 10–21. iv. 39.
♂ 2 ♀♀ (M. C. Z. 271121–23) Mbanja, T. T. 29. iv–2. v. 39.
♂ ♀ (M. C. Z. 271124–25) Lindi, T. T. 31. v. 39.
♂ (M. C. Z. 271126) Amboni Estate, T. T. 24. vi. 39.

Native names. Chiteri (Kimakonde); *msozi* (Kisambara).

Cyanomitra verticalis viridisplendens (Reichenow)

Cinnyris viridisplendens Reichenow, 1892, Journ. f. Orn., pp. 54, 132: Bukoba, Tanganyika Territory.

7 ♂♂ 1 ♀ (M. C. Z. 271127–34) Mihunga Ridge, U. 11–19. i. 39.
6 ♂♂ 1 ♀ (M. C. Z. 271135–41) Idjwi Id., B. C. 17. ii-2. iii. 39.

Cyanomitra olivacea neglecta Neumann

Cyanomitra obscura neglecta Neumann, 1900, Journ. f. Orn., p. 297: Kibwezi, Ukamba, Kenya Colony.

♀ (M. C. Z. 271142) Nchingidi, T. T. 10. v. 39.
♂♂ ♀ (M. C. Z. 271143–45) Magrotto Mtn., T. T. 29. vi & 13. vii. 39.

Anthreptes collaris zambesiana (Shelley)

Anthodiaeta zambesiana Shelley, 1880, Monogr. Nectarin., p. 243, pl. iii: Shupanga, Zambezi River, Mozambique.

♂♂ (M. C. Z. 271146–7) Kitaya, T. T. 3–4. iv. 39.
♂ (M. C. Z. 271148) Mikindani, T. T. 17. iv. 39.

Native names. Kasaragwe (Kiyao); *kitwi* (Kimakonde).

Anthreptes collaris elachior Mearns

Anthreptes collaris elachior Mearns, 1910, Smiths. Misc. Coll., **56**, No. 14, p. 5: Changamwe, Kenya Colony.

♂ ♀♀ (M. C. Z. 271152–54) Magrotto Mtn., T. T. 29. vi & 10. vii. 39.

Anthreptes collaris ugandae van Someren

Anthreptes collaris ugandae van Someren, 1921, Bull. Brit. Orn. Club, **41**, p. 113: Maraquet, *i.e.* Marakwet, Kerio Province, Kenya Colony.

♂ (M. C. Z. 271155) Budongo Forest, U. 29. xi. 38.
♀ ♀ (M. C. Z. 271156–7) Idjwi Id., B. C. 23–24. iii. 39.

Anthreptes tephrolaema tephrolaema (Jardine & Fraser)

Nectarinia tephrolaemus Jardine & Fraser, 1851, Contrib. Orn., p. 154: Fernando Po.

♂ (M. C. Z. 271158) Budongo Forest, U. 3. xii. 38.

ZOSTEROPIDAE

Zosterops virens scotti Neumann

Zosterops scotti Neumann, 1899, Orn. Monatsb., **7**, p. 24: Yerua Forest, Ruwenzori Mtns., 8000 feet.

Zosterops schubotzi Reichenow, 1908, Orn. Monatsb., **16**, p. 160: Lower slopes of Ronssoro, *i.e.* western slopes Ruwenzori Mtns., Belgian Congo.

♀ (M. C. Z. 271159) Mubuku Valley, U. 7. i. 39.
♂ ♂ ♀ (M. C. Z. 271160–2) Mihunga Ridge, U. 10–16. i. 39.
3 ♀ ♀ (M. C. Z. 271163–4) Idjwi Id., B. C. 18–20. ii–2. iii. 39.

Native names. *Kaboliamaisu* (Lukonjo); *mesu* (Lulega).

Zosterops virens stuhlmanni Reichenow

Zosterops stuhlmanni Reichenow, 1892, Journ. f. Orn., p. 54: Bukoba, Tanganyika Territory.

♂ (M. C. Z. 271165) Mabira Forest, U. 14. xi. 38.

This breeding male has been compared with a topotype of *stuhlmanni* from Chantwara, Bukoba.

PLOCEIDAE

Passer griseus mosambicus van Someren

Passer griseus mosambicus van Someren, 1921, Bull. Brit. Orn. Club, **41**, p. 114: Lumbo, Mozambique.

♀ (M. C. Z. 271166) Kitaya, T. T. 27. iii. 39.
♂ ♂ (M. C. Z. 271167–68) Mikindani, T. T. 21. iv. 39.
♀ (M. C. Z. 271169) Mbanja, T. T. 28. iv. 39.
♂ juv., ♀ ♀ (M. C. Z. 271170–72) Lindi, T. T. 31. v. 39.

Native names. *Kiswesu* (Kiyao); *nahoma* (Kimakonde).

Passer griseus ugandae Reichenow

Passer diffusus ugandae Reichenow, 1904, Vögel Afr., **3**, p. 231: Uganda.

♀ (M. C. Z. 271173) Nyakabande, U. 26. i. 39.

Petronia superciliaris (Blyth)

Gymnorhis superciliaris Blyth, 1845, Journ. Asiatic Soc. Bengal, **14**, p. 553: South Africa.

♂ (M. C. Z. 271174) Mbanja, T. T. 1. v. 39.

Ploceus bicolor stictifrons (Fischer & Reichenow)

Symplectes stictifrons Fischer & Reichenow, 1885, Journ. f. Orn., p. 373: Lindi, Tanganyika Territory.

♀ (M. C. Z. 271175) Nchingidi, T. T. 12. v. 39.

Ploceus bicolor kersteni (Finsch & Hartlaub)

Sycobrotus kersteni Finsch & Hartlaub, 1870, Vögel Ost-Afr., p. 404, pl. vi: Zanzibar.

♂ (M. C. Z. 271176) Magrotto Mtn., T. T. 8. vii. 39.

Ploceus stuhlmanni stuhlmanni (Reichenow)

Symplectes stuhlmanni Reichenow, 1893, Orn. Monatsb., **1**, p. 29: (Type in Berlin Mus. from Bukoba, Tanganyika Territory).

♂♂ (M. C. Z. 271177–78) Mihunga Ridge, U. 11 & 14. i. 39.
♂ (M. C. Z. 271179) Idjwi Id., B. C. 3. iii. 39.

Native names. Kisanda (Lutoro and Lukonjo); *chundabi* (Lulega).

Ploceus capitalis dimidiatus (Antinori & Salvadori)

Hyphantornis dimidiata Antinori & Salvadori, 1873, Atti R. Accad. Torino, **8**, p. 360: Kasala, Anglo-Egyptian Sudan.

♂ (M. C. Z. 271180) Budongo Forest, U. 1. xii. 38.

Ploceus nigriceps nigriceps (Layard)

Hyphantornis nigriceps Layard, 1867, Birds S. Afr., ed. 1, p. 180: Kuruman, British Bechuanaland.

8 ♂♂ (M. C. Z. 271181–88) Mikindani, T. T. 15. iv. 39.
♂ (M. C. Z. 271189) Mbanja, T. T. 28. iv. 39.

Native name. *Vanyehe* (Kimakonde).

Ploceus nigriceps graueri Hartert

Ploceus graueri Hartert, 1911, Bull. Brit. Orn. Club, **29**, p. 21: Usumbura, Belgian Ruanda-Urundi.

♂ (M. C. Z. 271190) Nyakabande, U. 28. i. 39.

This all black-headed weaver was in the same breeding colony, in the rest-camp grounds, as the very similar *feminina*, listed below, which, however, has the occipital region buffy orange.

Ploceus cucullatus feminina (Ogilvie-Grant)

Hyphantornis feminina Ogilvie-Grant, 1907, Bull. Brit. Orn. Club, **21**, p. 15: Mokia, Toro district, Uganda.

♂♂ ♀ (M. C. Z. 271191–3) Budongo Forest, U. 6. xii. 38.
4 ♂♂ (M. C. Z. 271194–7) Nyakabande, U. 28. i. & 7. ii. 39.

Breeding. On February 7, a nest and eggs were collected, but possibly are those of the last mentioned species occupying the same colony.

Ploceus ocularius suahelicus Neumann

Ploceus ocularius suahelicus Neumann, 1905, Journ. f. Orn., p. 339: Lewa, Usambara Mtns., Tanganyika Territory.

♂ (M. C. Z. 271198) Kitaya, T. T. 28. iii. 39.
♂ ♀ (M. C. Z. 271199–200) Magrotto Mtn., T. T. 13. vii. 39.

Ploceus aureoflavus aureoflavus Smith

Ploceus aureoflavus A. Smith, 1839, Ill. Zool. S. Afr., Aves, pl. xxx, fig. 1: "W. Africa," *errore;* probably Zanzibar.

3 ♂♂ (M. C. Z. 271201–3) Kitaya, T. T. 27 & 31. iii. 39.
♂ ♀ (M. C. Z. 271204–5) Mikindani, T. T. 15. iv. 39.
♀ (M. C. Z. 271206) Mbanja, T. T. 28. iv. 39.

Native names. *Njesi* (Kiyao); *lichendi* (Kimakonde at Kitaya); *vanyehe* (Kimakonde at Mikindani, but not specific).

Ploceus xanthops camburni (Sharpe)

Hyphantornis camburni Sharpe, 1900, Bull. Brit. Orn. Club, **10**, p. 35: Mt. Kenya, Kenya Colony.

♀ (M. C. Z. 271207) Idjwi Id., B. C. 22. ii. 39.

Native name. *Kishokoshoko* (Lulega).

Euplectes nigroventris Cassin

Euplectes nigroventris Cassin, 1848, Proc. Acad. Nat. Sci. Philadelphia, p. 66: Zanzibar.

♂ (M. C. Z. 271208) Kitaya, T. T. 25. iii. 39.
♂♂ ♀ (M. C. Z. 271209–11)Mikindani, T. T. 19. iv. 39.

Native names. *Chiunga* (Kiyao); *nanchilanga* (Kimakonde).

Euplectes hordacea changamwensis (Mearns)

Pyromelana flammiceps changamwensis Mearns, 1913, Smiths. Misc. Coll., **61**, no. 11, p. 5: Changamwe, near Mombasa, Kenya Colony.

3 ♂♂ (M. C. Z. 271212–4) Mikindani, T. T. 10. iv. 39.
♀ (M. C. Z. 271215) Mbanja, T. T. 29. iv. 39.
♂ ♀ (M. C. Z. 271216–7) Lindi, T. T. 2. vi. 39.
♂ (M. C. Z. 271218) Amboni Estate, T. T. 24. vi. 39.

Native name. *Gongwe* (Kisambara).

Euplectes capensis zambesiensis (Roberts)

Xanthomelas xanthomelas zambesiensis Roberts, 1922, Ann. Transvaal Mus., **8**, p. 266: Villa Pereira, Boror, Mozambique.

♂ (M. C. Z. 271219) Kitaya, T. T. 28. iii. 39.
♂♂ (M. C. Z. 271220–21) Mikindani, T. T. 10. iv. 39.

Wings of ♂♂, 66.5, 66.7, 68 mm.; tails of ♂♂, 14.9, 15.8 and 15.8 mm.

Native names. *Chiunga* (Kiyao); *lichende* (Kimakonde at Kitaya); *nanchilanga* (Kimakonde at Mikindani for all Bishop birds).

Euplectes capensis xanthomelas Rüppell

Euplectes xanthomelas Ruppell, 1840, Neue Wirbelth. Vögel, p. 94: Temben and Simien, Ethiopia.

♀ (M. C. Z. 271222) Mabira Forest, U. 11. xi. 38.
♂ (M. C. Z. 271223) Idjwi Id., B. C. 21. ii. 39.

The latter bird would be referable to *E. c. sabinjo* Reichenow (1910, Orn. Monatsb., **18**, p. 161: Sabinio Volcano, Kivu) were that form recognizable. Wings of ♂♂ from Addis Ababa are 77, 76, 74 mm.; tails 13, —, 13.5 mm., which may be contrasted with ♂♂ from Kilosa of 68.7, 67.5, 65 mm.; and tails of 16, 15.4, 13.7 mm.

Native name. *Kifigifigi* (Lulega).

Spermestes cucullatus cucullatus Swainson

Spermestes cucullatus Swainson, 1837, Birds W. Afr., **1**, p. 201: Senegal.

? (M. C. Z. 271224) Mabira Forest, U. 8. xi. 38.
♂ (M. C. Z. 271225) Budongo Forest, U. 24. xi. 38.

Spermestes cucullatus scutatus Heuglin

Spermestes scutatus Heuglin, 1863, Journ. f. Orn., p. 18: Dembea, Ethiopia.

♂ ♀ (M. C. Z. 271226–7) Kitaya, T. T. 25. iii. 39.
♂ (M. C. Z. 271228) Mikindani, T. T. 19. iv. 39.
♀ (M. C. Z. 271229) Mbanja, T. T. 28. iv. 39.

Native names. *Kapingo* (Kiyao); *upingo* (Kimakonde at Kitaya); *utiri* (Kimakonde at Mikindani).

Spermestes bicolor stigmatophorus Reichenow

Spermestes stigmatophorus Reichenow, 1892, Journ. f. Orn., p. 46: Bukoba, Tanganyika Territory.

♂ (M. C. Z. 271230) Idjwi Id., B. C. 28. ii. 39.

Native name. *Gongera* (Lulega).

Spermestes nigriceps nigriceps Cassin

Spermestes nigriceps Cassin, 1852, Proc. Acad. Nat. Sci. Philadelphia, p. 185: Zanzibar.

♂ (M. C. Z. 271231) Magrotto Mtn., T. T. 6. vii. 39.

Native name. *Mtongo* (Kisambara).

Nigrita canicapilla schistacea Sharpe

Nigrita schistacea Sharpe, 1891, Ibis, p. 118: Sotik, Kenya Colony.

♀ (M. C. Z. 271232) Budongo Forest, U. 1. xii. 38.

Spermophaga ruficapilla ruficapilla (Shelley)

Spermospiza rufiçapilla Shelley, 1888, Proc. Zool. Soc. London, p. 30: Bellima, Uelle district, Belgian Congo.

♀ (M. C. Z. 271233) Budongo Forest, U. 30. xi. 38.

Enemies. From the stomach of a bird snake (*Thelotornis k. kirtlandii*), killed at Buta, Uelle, B. C., we recently removed two large nestlings which Dr. J. P. Chapin has been able to identify generically by means of the three black palatal spots. Dr. Chapin states that *ruficapilla* has been collected at Buta by Hutsebaut, but the possibility remains that the rarer *poliogenys* may turn up there.

Hypargos niveoguttatus (Peters)

Spermophaga niveoguttata W. Peters, 1868, Journ. f. Orn., p. 133: Inhambane, Mozambique.

♂ (M. C. Z. 271234) Mikindani, T. T. 17. iv. 39.

Native name. *Linguruguru* (Kimakonde).

Pytilia melba grotei Reichenow

Pytelia [*sic*] *melba grotei* Reichenow, 1919, Journ. f. Orn., p. 227: Kionga, S. bank Rovuma River, Mozambique.

♂ ♂ (M. C. Z. 271235–6) Kitaya, T. T. 28. iii. 39.

Almost topotypic, Kitaya being on the north bank just a few miles above Kionga.

Native names. *Kapalanganga* (Kiyao); *chanika* (Kimakonde).

Lagonosticta rubricata haematocephala Neumann

Lagonosticta rubricata haematocephala Neumann, 1907, Orn. Monatsb., **15**, p. 168: Songea, Tanganyika Territory.

♂ ♀ (M. C. Z. 271237–38) Kitaya, T. T. 3. iv. 39.
♀ (M. C. Z. 271239) Mikindani, T. T. 21. iv. 39.

Native names. *Kapelepete* (Kiyao); *chinonombe* (Kimakonde at Kitaya); *chididi* (Kimakonde at Mikindani).

Coccopygia melanotis nyanzae (Neumann)

Neisna dufresneyi nyansae Neumann, 1905, Journ. f. Orn., p. 350: Bukoba, Tanganyika Territory.

Neisna minima Ogilvie-Grant, 1906, Bull. Brit. Orn. Club, **16**, p. 117: Mubuku Valley, Ruwenzori Mtns., 6000 feet, Uganda.

3 ♂♂ 2 ♀♀ (M. C. Z. 271240–4) Mubuku Valley, U. 2 & 7. i. 39.
♂ ♀ (M. C. Z. 271245–6) Idjwi Id., B. C. 27. ii. 39.

The Ruwenzori series are topotypes of *minima*.

Native name. *Katwasundi* (Lukonjo).

Estrilda astrild minor (Cabanis)

Habropyga minor Cabanis, 1878, Journ. f. Orn., p. 229: Voi River, Kenya Colony.

♂ (M. C. Z. 271247) Nchingidi, T. T. 17. v. 39.
♀ (M. C. Z. 271248) Siga Caves, T. T. 8. vi. 39.
2 ♂♂ 2 ♀♀ (M. C. Z. 271249–52) Magrotto Mtn., T. T. 29. vi. & 5. vii. 39.

Native name. *Mseke* (Kisambara).

Estrilda astrild nyanzae Neumann

Estrilda astrild nyanzae Neumann, 1907, Journ. f. Orn., p. 596: Bukoba, Tanganyika Territory.

♂ ♀ (M. C. Z. 271253–4) Idjwi Id., B. C. 21. ii & 2. iii. 39.

Native name. *Roboneka* (Lulega).

Estrilda nonnula nonnula Hartlaub

Astrilda [*sic*] *nonnula* Hartlaub, 1883, Journ. f. Orn., p. 425: Kudurma, Bahr el Ghazal, Anglo-Egyptian Sudan.

3 ♀♀ (M. C. Z. 271255–57) Budongo Forest, U. 28. xi–6. xii. 38.
1 ♂ 3 ♀♀ (M. C. Z. 271258–61) Mihunga Ridge, U. 12. i. 39.
3 ♂♂ 3 ♀♀ (M. C. Z. 271262–5) Idjwi Id., B. C. 18. ii–3. iii. 39.

Native name. *Funzi* (Lulega).

Uraeginthus angolensis niassensis Reichenow

Uraeginthus bengalus niassensis Reichenow, 1911, Mitt. Zool. Mus. Berlin, **5**, p. 228: Songea, Tanganyika Territory.

♂ ♀ (M. C. Z. 271266–7) Kitaya, T. T. 31. iii. 39.
♂ ♀ ♀ (M. C. Z. 271268–70) Mikindani, T. T. 18–19. iv. 39.
3 ♂♂ 3 ♀♀ (M. C. Z. 271271–6) Mbanja, T. T. 26. iv. 39.

Native names. *Kitwitwitwi* (Kiyao); *chididi* (Kimakonde at Kitaya and Mikindani, but not specific).

Vidua macroura (Pallas)

Fringilla macroura Pallas, 1764, in Vroeg, Cat., Adumbrat., no. 144, p. 3: "East Indies," (Angola, *fide* Edwards & Brisson).

♀ (M. C. Z. 271277) Budongo Forest, U. 1. xii. 38.
♂ (M. C. Z. 271278) Idjwi Id., B. C. 2. iii. 39.
♂ (M. C. Z. 271279) Kitaya, T. T. 30. iii. 39.
♂ (M. C. Z. 271280) Mikindani, T. T. 18. iv. 39.
♂ (M. C. Z. 271281) Mbanja, T. T. 6. v. 39.

All the males, with the exception of the Kitaya bird, possess full nuptial tail feathers.

Native names. *Lulangiragira* (Lulega); *chiunga* (Kiyao); *nandumbi* (Kimakonde at Kitaya and Mikindani).

Steganura paradisaea (Linnaeus)

Emberiza paradisaea Linnaeus, 1758, Syst. Nat. ed. 10, **1**, p. 178: Africa (restricted to Angola in ed. 12, p. 312).

♂ (M. C. Z. 271282) Mbanja, T. T. 6. v. 39.

In full breeding plumes. We follow Chapin (1922, Amer. Mus. Nov., no. 43, pp. 1–12) who, with more material, decided to separate *paradisaea* from the *aucupum* group on account of the overlap in ranges, and as both species have been recorded as breeding in the same localities.

FRINGILLIDAE

Poliospiza striolata graueri (Hartert)

Serinus striolata graueri Hartert, 1907, Bull. Brit. Orn. Club, **19**, p. 84: Ruwenzori Mtns. 7000 feet, Uganda.

♀ (M. C. Z. 271283) Mihunga Ridge, U. 16. i. 39.

Native name. Kiswere (Lukonjo).

Poliospiza burtoni tanganjicae (Granvik)

Serinus albifrons tanganjicae Granvik, 1923, Journ. f. Orn., Sonderheft, p. 191: Lake Tanganyika (ex. Reichenow MS.).

♂ ♀ (M. C. Z. 271284–5) Mihunga Ridge, U. 10. i. 39.

Native name. Kiswere (Lukonjo).

Spinus citrinelloides frontalis Reichenow

Spinus citrinelloides frontalis Reichenow, 1904, Vögel Afr., **3**, p. 275: (Type in Berlin Mus. from Lake Kivu).

♂ ♀ (M. C. Z. 271286–7) Mihunga Ridge, U. 10 & 16. i. 39.
♀ (M. C. Z. 271288) Idjwi Id., L. Kivu, B. C. 28. ii. 39.

Native names. Kasande or *Kanyangaleka* (Lukonjo); *kararamazi* (Lulega).

EXPLANATION OF PLATES

PLATE 1

PLATE 1

Map showing Principal Collecting Localities

1938

Landing at Mombasa (25.x), except for a stopover at Naivasha and Kinangop (26–31.x), Loveridge proceeded by rail direct to Jinja (1–5.xi). Thence to Mabira Forest (5–21.xi), Budongo Forest (22.xi–7.xii), Kibale Forest (8–19. xii), Bundibugyo near Bwamba Forest (19–26.xii), Bugoye, foot of Ruwenzori Mountains (26–28.xii) and Mubuku Valley at 7000 ft. (29.xii–).

1939

On leaving Mubuku (9.i) Loveridge descended down the valley to Mihunga, *circa* 6000 ft. (9–21.i), then back to Bugoye (21–24.i), Nyakabande (25–30.i), Mushongero (30.i–4.xi), returned to Nyakabande (4–8.ii); Kisenyi (8–13.ii), Goma (13–14.ii), Mamvu on Idjwi Island (14–16.ii), Upper Mulinga on Idjwi (16.ii–6.iii), Uvira (7–8.iii), Ujiji (9–16. iii), Dar es Salaam (18–19.iii), Mikindani (22–24.iii), Kitaya (24.iii-7.iv), Mikindani (7-24.iv), Mbanja (25.iv–6.v), Lake Rutamba (6–8.v), Nchingidi (9–21.v), Lindi (22.v–4.vi), Siga Caves (7–17, vi), Amboni Estate (17–27.vi), Magrotto Mountain (27.vi–21.vii), Tanga (21–23.vii), Kilindini (24–26.vii).

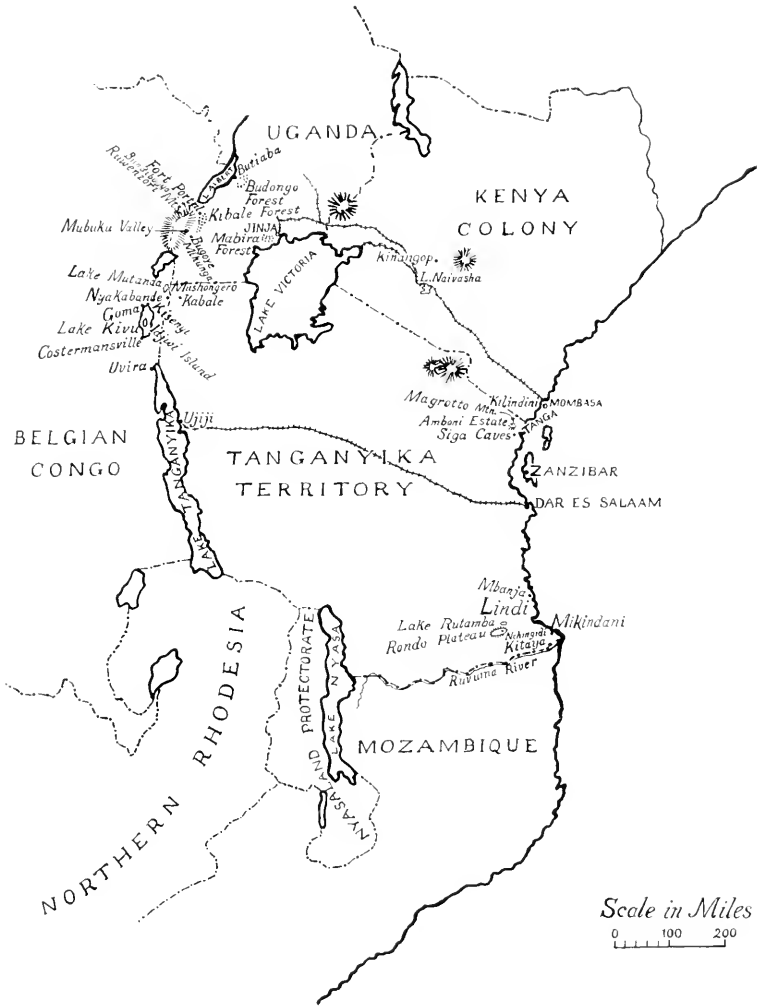
UGANDA
KENYA
COLONY
Fort Portal
Kibale Forest
Budongo Forest
JINJA
Mabira Forest
Mubuku Valley
Ruwenzori
Lake Mutanda
Nyakabande
Mushongero
Kabale
Guma
Kitesyi
Lake Kivu
River Island
Costermansville
Uvira
LAKE VICTORIA
Kimusop.
L. Naivasha
Magretto Mts.
Kilindini
MOMBASA
Amboni Estate
Siga Caves
TANGA
BELGIAN
CONGO
Ujiji
TANGANYIKA
TERRITORY
ZANZIBAR
DAR ES SALAAM
LAKE TANGANYIKA
Mbanja
Lindi
Mikindani
Lake Rutamba
Rondo Plateau
Nikingedi
Kitaya
Ruvuma River
NORTHERN RHODESIA
NYASALAND PROTECTORATE
LAKE NYASA
MOZAMBIQUE
Scale in Miles
0 100 200

PLATE **2**

PLATE 2

Fig. 1. Nestling Crowned Crane (*Balearica p. gibbericeps*)

The beautiful crowned crane is protected throughout East Africa, despite the fact that in certain localities it destroys seed-corn. The natives of Ruanda appear to be unaware of the regulations as several nestlings were offered for sale at Nyakabande, and a clutch of eggs at Mushongero, on Lake Mutanda.

Fig. 2. Nest of White-breasted Cormorant (*Phalacrocorax c. lugubris*)

A huge colony of these birds had their nests on a little island in Lake Mutanda, but when we visited the nests on February 1, the young had all left them. An immature pair, which had been feeding on catfish, established identity, and seem to constitute the first record of the Red Sea race breeding in the Kivu region, according to Dr. J. P. Chapin.

1

2

PLATE 3

PLATE 3

Fig. 1. Camp at edge of Budongo Forest, Uganda.

The Budongo constitutes an extensive belt of primeval forest lying to the east of Lake Albert in northwestern Uganda. The drying safe in the foreground protects bird-skins from ovulating flies and other pests, furnishes shade, and facilitates their quick removal to cover in sudden downpours. The safe is so light it can be carried on a porter's head, or can be quickly taken down and packed flat for truck transport.

Fig. 2. Kizamba, a Mganda, skinning birds

Both Baganda skinners rapidly mastered their work and turned out good skins. Wherever we went they were a source of wonderment and interest to the local youngsters. In the background can be seen the trees surrounding the Rest Camp at Nyakabande, in which flocks of noisy weavers were nesting. The colony was composed of two species, distinct, yet strangely similar.

1

2

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GROWTH AND DEVELOPMENT OF THE PROBOSCIS MONKEY

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WITH FOUR PLATES

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No. 6.—*Growth and Development of the Proboscis Monkey*

By Adolph H. Schultz

INTRODUCTION

In the study of taxonomic and phylogenetic problems relating to primates very little consideration has been given so far to the conditions of growth and development. The changes with age in an animal or man are more profound and extensive than the changes with geological age in the evolutionary history of the species. The reconstruction of the latter is largely dependent upon luck in finding fossil remains, limited at best to skeletal and dental parts, and will always have to rest heavily upon indirect evidence of a comparative-anatomical nature. For the construction of complete ontogenetic histories the necessary materials can be made available, even though this is often far from easy. Species characters are in the last analysis nothing but the end results of inherited ontogenetic processes, and alterations in the latter bring about changes in the former. We possess surprisingly little reliable and comprehensive information regarding the similarities and dissimilarities in the ontogenetic conditions of primates. Thus we are still quite unable to state fully to what extent and in which respects the growth of man differs from the growth of apes and monkeys, yet such knowledge promises to shed new light on the great problem of the origin of man.

The present paper is intended chiefly as a record of the conditions of growth and development in an Old World monkey, and as such is to be regarded as a contribution toward the eventual accumulation of data sufficient for general comparisons of the ontogenetic conditions in primates. The proboscis monkey (*Nasalis larvatus*), which is the subject of this study, belongs to the catarrhine subfamily of *Semnopithecinae*, a group of primates for which there exists particularly scant information regarding growth. Breschet (1845) has pictured and briefly described two fetuses of the proboscis monkey and Keibel (1906) has contributed a few data on and illustrations of two other fetuses of the same primate species. Schwalbe (1911) has listed some measurements of four fetuses of the proboscis monkey and has given a detailed description of the direction of the hair in the oldest of these specimens. The measurements by Schwalbe and those by Breschet

are of very limited value chiefly because these authors failed to define adequately their methods of measuring. Wiedersheim (1901a) reported on one fetus and one juvenile proboscis monkey, dealing principally with the anatomy of the nose. The author (1935), finally, has published a tentative account of the sequence of eruption of the permanent teeth in *Nasalis* and investigated the age changes in the relative length of the various regions of the spinal column (1938a) and the age changes in the proportionate size of the eye and the orbit (1940 b) in the same primate. As far as the writer can ascertain these are the only papers dealing with one or another phase of growth and development in the proboscis monkey.

It must be mentioned here that the technique of the measurements and proportions used in this paper has already been described in full detail in a special publication by the author (1929) and, hence, can not be repeated here.

This investigation represents one of the results of the Asiatic Primate Expedition of 1937 in which the writer had participated. This expedition had been organized and aided in manifold ways by Mr. H. J. Coolidge, Jr. of the Museum of Comparative Zoölogy of Harvard University. Permission for the collecting of a series of proboscis monkeys was granted by the authorities of British North Borneo, who facilitated the work of the expedition in the most generous manner. The author is particularly indebted to Mr. H. G. Keith, Conservator of Forests of British North Borneo, for his many helpful acts which contributed enormously to the success of the expedition. During the field-work in Borneo the writer was very ably assisted by his friend, Dr. S. L. Washburn, whose conscientious and untiring labors greatly furthered the collection of the specimens and data used for this paper.

Finally, the author wishes to express his sincere thanks to Prof. M. Brödel for the excellent portrait studies of adult proboscis monkeys which appear as plates 1, 2 and 3. These are based upon plaster death-masks which the writer had made in the field on freshly killed specimens.

MATERIAL

The series of proboscis monkeys, studied by the author, consist of a total of 51 bodies and one of 41 skeletons (and 2 skulls). The entire skeletal series is derived from the series of bodies. Among the latter there are 6 fetuses, 13 infants, 7 juveniles, 15 adult females, and 10 adult males. The term "infant" is applied to all specimens with in-

complete or complete deciduous dentition, but as yet no permanent teeth. "Juveniles" are specimens with at least one, but not all permanent teeth completely erupted. A specimen is classified as "adult" when its permanent dentition is complete regardless of the state of epiphyseal union or of cranial suture closure. An occasional reference to an "old" animal indicates that there exists an advanced degree of attrition of the teeth. The series of skeletons consists of 9 infants (in addition to which some X-ray photographs could be consulted), 7 juveniles, and 25 adults. Forty-two of these specimens (including two fetuses) were collected on the Asiatic Primate Expedition of 1937 at Abai on the Kinabatangan river in British North Borneo. All this material was weighed, measured and autopsied in the field, and all specimens of postnatal ages, except the youngest infant, were made into skeletons. All the skeletons, except two which had been given to the author, belong to the Museum of Comparative Zoölogy of Harvard University. The writer is very grateful to Dr. T. Barbour and Mr. H. J. Coolidge, Jr. for the loan of this material over a period of more than two years. Three fetal and one infantile proboscis monkeys have been measured by the author at the U. S. National Museum, with the kind permission of Mr. G. S. Miller, Jr., and one fetal and two infantile specimens had been examined by the writer at the Wistar Institute of Anatomy when under the directorship of the late Dr. M. J. Greenman. The body of one proboscis monkey from Dutch Borneo had generously been sent to the author by Dr. L. M. Huey of San Diego. This specimen was later made into a skeleton. In the author's collection there are also two skulls of adult *Nasalis larvatus* which come from Dutch Borneo and have been made use of in this study. The above-mentioned specimens from the National Museum and those from the Wistar Institute also come from various localities in Dutch Borneo. It may be mentioned here that in regard to the characters dealt with in this paper no differences could be detected between the proboscis monkeys from different parts of Borneo.

GROWTH IN GENERAL

Nothing is known in regard to the durations of the various periods of growth in the proboscis monkey, but it may be assumed that these do not differ radically from the conditions in macaques. In the latter pregnancy is known to last 166 days (Hartman, 1932) and the permanent dentition is completely erupted at the age of 7 years (Schultz, 1940a).

The youngest proboscis monkey infant collected showed a conspicuous and quite fresh umbilical scar and had only a few milk incisors just appearing above the gums. This specimen weighed 0.454 kg., or only little more than the oldest fetus. It can be safely concluded, therefore, that this infant had been born quite recently and that the weight of the proboscis monkey at birth equals approximately 0.45 kg.

The weight of adult proboscis monkeys averages in females (15 specimens) 9.873 kg. and in males (10 specimens) 20.344 kg. Individually the weight varies among these fully adult specimens between 8.165 and 11.794 kg. in females and between 14.062 and 23.587 kg. in males. This sex difference in size in the proboscis monkey, showing a ratio of roughly 1:2, is equalled among simian primates by only a few forms, such as orang-utan, gorilla, and some baboons.

The weight of the newborn in percentage of the average weight of adult females amounts to 4.6 in the proboscis monkey. The corresponding figures for other primates are, as far as could be established so far, 6.7 in macaques, 4.1 in orang-utans, 4.0 in chimpanzees, and 5.5 in man (Schultz, 1941).

In contrast to macaques and orang-utans, proboscis monkeys seem not to become pregnant until their permanent dentition is completed. Out of 15 adult female proboscis monkeys only two were pregnant, one containing a very small embryo and the other double-ovum twins of the second half of intrauterine development. Four other females, collected at practically the same time, had very large mammary glands containing a copious supply of fresh milk and were accompanied by infants of varying size. These data support the conclusions that there can not exist any breeding season for proboscis monkeys and that their fertility is comparatively low[1].

GROWTH CHANGES IN BODY PROPORTIONS

The proportions of the outer body undergo changes with advancing age due to differing rates of growth in the bodily parts to which the proportions refer. The growth changes in the main proportions of the trunk of the proboscis monkey are shown by the data in table 1. The chest circumference (at level of insertion of fourth pair of ribs) in percentage of the trunk height (from supra-sternal notch to upper end of pubic symphysis) decreases with growth, but increases again in males during adult life. The general ontogenetic drop in this index agrees

[1]Among 14 adult female *Macaca irus*, collected at the same place and time, 7 were pregnant, some having very small embryos, others nearly full-term fetuses.

with the findings in all other primates examined so far (Schultz, 1926, 1937) and a marked, late, secondary rise in males occurs also in orang-utan (Schultz, 1941) and in man. Judging by samples of other adult lower catarrhines, among which this index varies between 83 and 129 (Schultz, 1933a), the proboscis monkey is characterized by a comparatively stout trunk, particularly the males, though even the latter have a much more slender trunk than any of the higher primates (see also table 5).

Table 1

Age changes in the proportions of the trunk and tail in proboscis monkeys. Averages (above) and ranges of variations (omitting decimals, below).

Age	*Specimens*	*Relative Chest Circumfer.*	*Relative Shoulder Breadth*	*Relative Hip Breadth*	*Chest Index*	*Relative Tail Length*
Fetuses	6	146.9 137–165	46.4 44–51	37.8 35–40	95.2 93–100	162.7 143–192
Infants	13	121.4 112–137	39.8 33–46	37.4 35–40	96.3 91–104	190.8 166–209
Juveniles	7	110.4 99–120	33.4 31–37	33.3 31–35	96.6 93–100	169.8 162–184
Adults ♀	15	108.0 96–120	33.0 30–38	33.6 32–35	99.5 95–103	152.3 139–169
Adults ♂	10	125.0 112–135	38.0 36–42	36.8 34–40	99.6 95–104	156.6 143–167

The percentage relation between the shoulder breadth and the trunk height decreases with advancing age in the proboscis monkey, as in the other primates studied so far. Adult males of the proboscis monkey, as those of chimpanzee and of orang-utan (Schultz, 1941), acquire secondarily relatively broad shoulders in connection with the widening of the chest.

The relative hip breadth (bitrochanteric diameter in percentage of trunk height) changes comparatively little during growth, though its

general trend is to decrease somewhat. Adult males possess a higher average index than adult females. This, however, must be due to stronger heads and necks of the femora in the larger males, since the relative width of the pelvic inlet is slightly greater in females than in males. The latter proportion (pelvic inlet breadth in percentage of trunk height) averages 13.2 in adult females and 12.9 in adult males; in infants and in juveniles it averages only 10.7. A closely corresponding age change and sex difference in this index has been found also in chimpanzee and in orang-utan (Schultz, 1940a, 1941). Incidentally, the pelvic inlet is proportionately larger in females than in males also in its sagittal diameter, as shown by the following averages for adult proboscis monkeys: Promontorium to symphysion in percentage of trunk height = 18.3 in females and 16.4 in males.

The chest index (transverse diameter of chest in percentage of sagittal diameter, at same level as chest girth) increases slightly with growth, but remains in its averages below 100, in contrast to all higher primates in which it rises to way above 100 during postnatal growth; i. e., the chest becomes much wider than it is deep. The shape of the thoracic cavity undergoes also some change with age in the proboscis monkey, as shown by figure 1. The most noteworthy of these changes is the slight, but nevertheless significant shift of the spinal column toward the center of the thorax. This ontogenetic, topographic change is much more pronounced in man and the great apes than in the lower catarrhines (see figure 1 and, for further discussion, Schultz, 1941).

The relative length of the tail (tail length, measured with tape, ventrally, from root to tip of outer tail, in percentage of trunk height) undergoes very considerable changes with age in the proboscis monkey, as shown by the data in table 1. This proportion increases at first, to reach its maximum values during infantile life, and decreases subsequently until cessation of growth in adult life. This decrease in relative tail length during postnatal growth is the general rule in tailed monkeys, as has been demonstrated in other publications by the author (1938 and, by repeated measurements on living macaques, 1933b).

The growth changes in the most significant proportions of the limbs of the proboscis monkey are shown in table 2. The average relative lower limb length (thigh length + knee height in percentage of trunk height) increases during the latter part of fetal life, reaching its maximum values among infants, and decreases somewhat thereafter. Closely corresponding age changes take place in the relative upper limb length (upper arm length + forearm length + hand length in per-

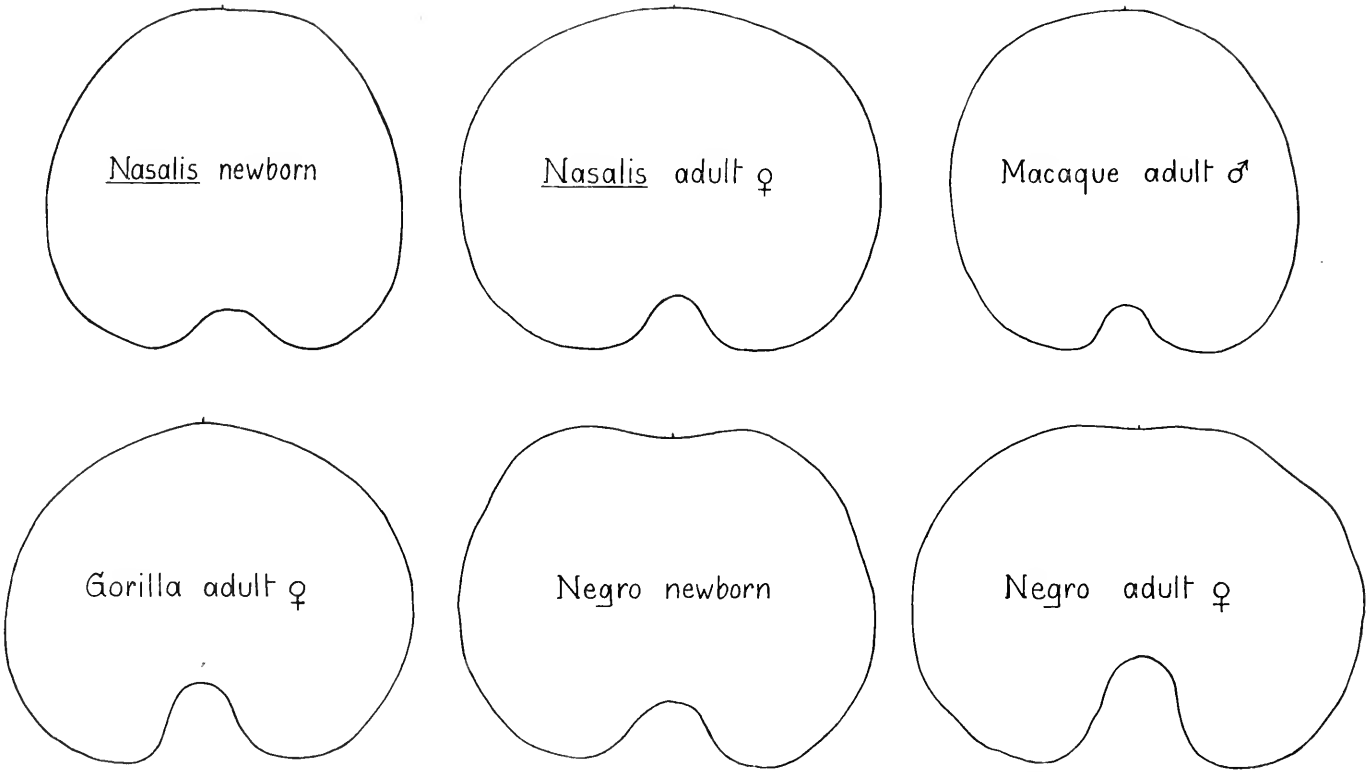

Fig. 1. Tracings of plaster casts of eviscerated thoracic cavities, cut perpendicular to thoracic spine at level of insertion on sternum of fourth pair of ribs, all reduced to same height of tracing.

centage of trunk height). The ontogenetic alterations in these relations between limb lengths and trunk height are at least in their direction strikingly similar to the corresponding growth changes in macaque and in orang-utan (Schultz, 1937, 1941), but they differ from the conditions in man and chimpanzee (Schultz, 1926, 1940a).

Table 2

Age changes in the proportions of the limbs in proboscis monkeys. Averages (above) and ranges of variations (omitting decimals, below).

Age	*Specimens*	*Relative Lower Limb Length*	*Relative Upper Limb Length*	*Intermembral Index*	*Crural Index*	*Brachial Index*
Fetuses	6	106.9 97–122	141.9 133–159	132.8 129–137	85.2 83–88	91.5 87–96
Infants	13	120.4 112–129	152.2 139–162	126.3 121–153	87.4 85–90	96.5 91–100
Juveniles	7	113.3 109–116	137.5 133–143	121.2 117–124	88.7 87–92	97.8 93–102
Adults ♀	15	109.1 105–115	132.2 126–140	121.0 119–124	87.7 86–90	99.5 94–102
Adults ♂	10	113.6 108–118	137.6 129–142	121.2 119–125	88.1 84–91	100.3 98–102

The intermembral index (total length of upper limb in percentage of total length of lower limb) decreases somewhat with advance in age, i. e., the lower limb grows faster than the upper one. The same general growth change in this proportion occurs in the macaque, chimpanzee and man (Schultz, 1926, 1937, 1940a), but not in the orang-utan in whom this index is practically constant (Schultz, 1941). The crural index (length of leg in percentage of length of thigh) increases slightly with advancing growth and the brachial index (length of forearm in

percentage of length of upper arm) rises considerably. Particularly an ontogenetic increase in the latter index represents the rule among primates, including man.

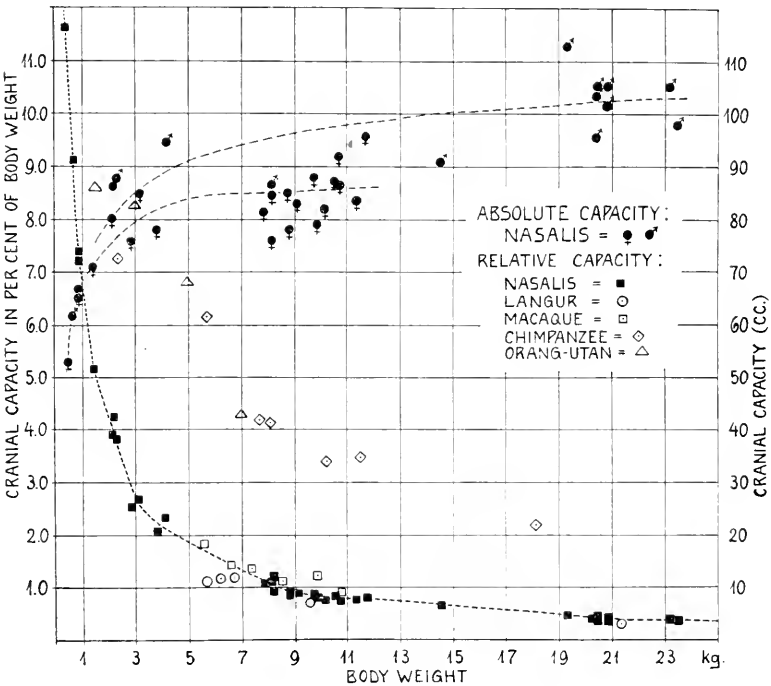

Fig. 2. Correlation between absolute and relative cranial capacity and body weight in the proboscis monkey and (for relative capacity only) in some other primates.

The percentage relations between breadth and length of the foot and of the hand of proboscis monkeys are shown in table 3. Both the foot and the hand become more slender during growth, as they do in all the primates studied so far. The only exception to this general rule consists in the trend among males to broaden hand and foot again slightly late in growth. The relative length of the thumb (total thumb length in percentage of greatest total hand length) decreases with advancing age in the proboscis monkey, as it does in most other primates

for which relevant data have become available. In all 51 specimens of *Nasalis* the fourth digits greatly surpass the second in length in the hand as well as in the foot and this regardless of age. In five instances the fourth fingers even equal the middle fingers in length. The toes

Table 3

Age changes in the proportions of the foot and the hand in proboscis monkeys. Averages (above) and ranges of variations (omitting decimals, below).

Age	*Specimens*	*Relative Foot Breadth*	*Relative Hand Breadth*	*Relative Thumb Length*
Fetuses	6	26.4 25–29	40.3 37–42	49.2 48–51
Infants	13	23.1 21–25	33.5 29–38	47.7 42–51
Juveniles	7	21.3 20–22	28.9 27–31	47.1 44–51
Adults ♀	15	21.9 20–23	28.5 27–31	45.0 42–48
Adults ♂	10	23.1 22–24	29.0 27–30	44.3 41–50

II to V are always webbed in the region of the basal phalanges. Between toes II and III this webbing extends frequently as far as the middle of middle phalanx II, and in three cases it reaches even the distal end of the latter phalanx, or fully as far as in any specimens of *Symphalangus syndactylus* (Schultz, 1933 c, table 18).

The growth changes in the most significant proportions of the head of the proboscis monkey are shown by the data in table 4 and are illustrated in figure 3 and plates 1–3. Very few indices change during growth as extensively as the relative head size (arithmetic mean of head length, breadth and height in percentage of trunk height). On an average this proportion decreases in proboscis monkeys from 49 in

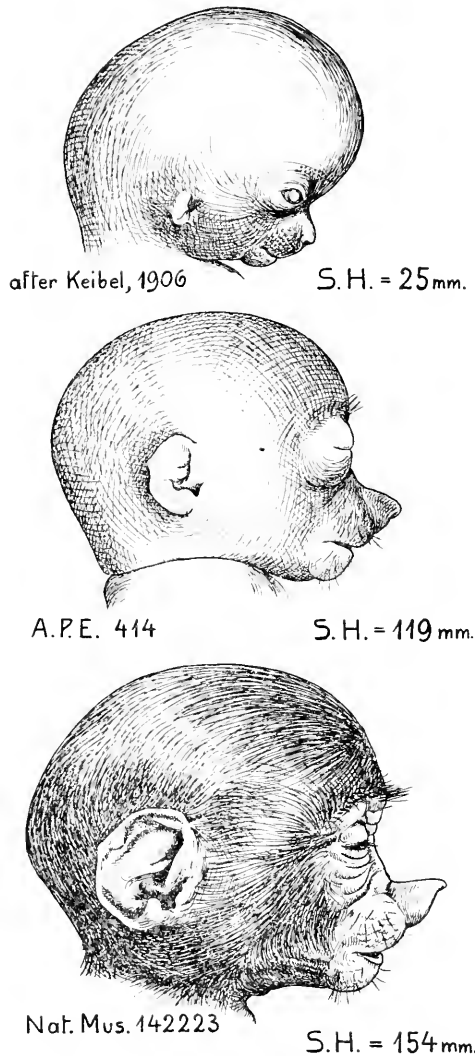

Fig. 3. Side views of heads of proboscis monkey fetuses, posed in ear-eye horizon. S. H. = sitting-height.

fetuses to only 17 in adults. The average head diameter gives only an approximate indication of the size of the brain and is more closely correlated with the latter in early than in late stages of growth. To gain some information on the growth of the brain, the cranial capacity has been measured (with rape seed) in the entire series of *Nasalis* skulls. This capacity averages 70.0 cc. in 9 infants, 83.1 cc. in 7 juveniles, 84.8 cc. in 15 adult females, and 102.1 cc. in 10 adult males. As best shown by figure 2, the cranial capacity increases very rapidly at first, but continues to gain at a very much slower rate during the later part of juvenile life. In its relation to body weight (in g.) the cranial capacity (in cc.) decreases during growth enormously until about the middle of the juvenile period. Thereafter this percentage relation diminishes more gradually with increasing body weight, i. e., the larger a specimen the proportionately smaller is its braincase. This *relative* cranial capacity averages in *Nasalis* 7.01 in infants, 2.23 in juveniles, 0.88 in adult females, and only 0.51 in adult males. The marked sex difference in adults is mostly, if not entirely, due to the striking sex difference in general body size. From figure 2 it is evident that the relative size of the cranial capacity of *Nasalis* does not differ significantly from that of langurs and macaques of corresponding body weight.[1] These lower catarrhines stand far below the great apes in regard to their relative cranial capacities (see also Schultz, 1941, fig. 4).

The relative face height (total face height in percentage of trunk height) decreases in general during growth, i. e., the height of the face increases at a slower rate than the height of the trunk. This is a general rule among primates, as far as is known so far. In male proboscis monkeys the face becomes proportionately higher again late in growth, undoubtedly in connection with the final phases of development in their large dental apparatus.

The first two indices in table 4 dealt with the relations in size between the brainpart as well as the facepart of the head and the trunk. It was shown that the first of these relations changes with age very much more than the second. From this it can be anticipated that the proportion between the size of the face and the size of the brainpart of the head also changes during growth. The latter relation is expressed precisely by the relative upper face height (distance between nasion and stomion in percentage of average head diameter). This

[1]As it happens, all the records for 5 langurs (different species) fall slightly below the curve for *Nasalis* and the data for 5 out of the 6 macaques lie a little above this curve. It requires many additional data before it can be decided whether there exists here a real, though at best slight, difference.

Table 4

Age changes in the proportions of the head of proboscis monkeys. Averages (above) and ranges of variations (omitting decimals, below).

Age	*Specimens*	*Relative Head Size*	*Relative Face Height*	*Relative Upper Face Height*	*Cephalic Index*	*Face Index*	*Interocular Index*	*Relative Ear Size*
Fetuses	6	49.2 44–51	25.7 24–27	40.5 36–44	86.3 82–91	43.1 38–47	21.9 18–24	7.4 5–10
Infants	13	35.8 27–44	23.1 20–27	44.0 40–51	80.4 74–84	46.1 41–51	19.1 17–20	12.7 11–14
Juveniles	7	21.7 18–26	18.0 17–20	58.1 52–69	83.3 81–85	54.6 51–61	19.2 17–21	9.8 9–10
Adults ♀	15	17.4 17–19	16.7 16–18	69.3 65–73	84.1 77–90	60.9 57–65	19.7 17–22	8.4 7–11
Adults ♂	10	17.1 16–18	18.8 18–20	80.0 74–89	86.2 80–91	66.4 61–73	21.8 19–25	7.5 6–9

index increases in proboscis monkeys from an average of 40 in fetuses to one of 80 in adult males. The rise in this index is greatest after infantile life when the braincase has attained most of its final size, while the face grows most intensively under the influence of the greatly expanding second dentition.

The cephalic index (greatest head breadth between temporal muscles in percentage of greatest head length from glabella) of the proboscis monkey decreases during the early growth period, only to increase again during juvenile life. The latter rise in this index is caused by the strong development of the temporal muscles accompanying the completion of the permanent dentition. The shape of the braincase itself becomes steadily narrower in relation to its length, as is shown by the following averages for the cranial index (greatest breadth of braincase above supramastoid ridges in percentage of greatest mid-sagittal length of braincase from glabella): infants = 80.3, juveniles = 77.5, adult females = 72.4, adult males = 69.7. A corresponding decrease in this index has been found in chimpanzee and in orang-utan (Schultz, 1940a, 1941). The relation between the height and the length of the skull (greatest skull height from basion, perpendicular to ear-eye horizon, in percentage of skull length from glabella) also decreases with age in the proboscis monkey, i. e., the skull becomes gradually lower in relation to its length. This is demonstrated by the following averages: infants = 64.8, juveniles = 64.5, adult females = 60.5, adult males = 57.9 (see also fig. 7). In the orang-utan this index remains constant during postnatal growth (Schultz, 1941).

The face index (upper face height in percentage of face breadth between zygomatic arches) increases very markedly with advance in age not only in the proboscis monkey (table 4), but also in orang-utan and chimpanzee (Schultz, 1940a, 1941) as well as in man. The interocular index (breadth between inner angles of the eye-clefts in percentage of face breadth) of proboscis monkeys decreases with growth from fetal to infantile life and increases again thereafter, particularly in males. These ontogenetic changes correspond exactly to those occurring in orang-utan and chimpanzee (Schultz, 1940a, 1941).

The last index in table 4 shows the relative size of the outer ear (ear height $\times$ ear breadth in percentage of head length $\times$ total head height) in proboscis monkeys of different ages. According to this index the outer ears become proportionately larger until infantile life (see also figure 3), to decrease again in relative size during later stages of growth. This is precisely what happens also in man, orang-utan and chimpanzee (Schultz, 1933a, 1940a, 1941).

Table 5

Averages of some body proportions of adult proboscis monkeys compared with corresponding averages of adult langurs and macaques. The data for *Macaca mulatta* are from a former paper by the author (1937), but include those for two new males. All other data are from specimens collected and measured in Borneo on the Asiatic Primate Expedition of 1937.

Species	*Sex*	*Specimens*	*Rel. Chest Circumfer.*	*Rel. Tail Length*	*Rel. lower Limb Length*	*Rel. upper Limb Length*	*Intermembral Index*	*Rel. Head Size*	*Rel. Face Height*	*Rel. upper Face Height*	*Interocular Index*	*Rel. Ear Size*
Nasalis larvat.	♀	15	108.0	152.3	109.1	132.2	121.0	17.4	16.7	69.3	19.7	8.4
	♂	10	125.0	156.6	113.6	137.6	121.2	17.1	18.8	80.0	21.8	7.5
Pygathrix rubic.	♀	5	102.9	200.2	115.3	120.5	104.4	17.9	15.1	56.2	21.5	12.4
	♂	5	111.0	197.3	120.2	123.5	102.5	18.7	15.5	53.7	21.3	11.9
Pygathrix crist.	♀	7	102.4	195.5	99.1	108.3	109.3	17.2	14.4	56.7	22.4	14.1
	♂	6	108.8	201.2	101.9	112.7	110.5	17.8	15.8	58.1	21.7	13.3
Macaca irus	♀	5	103.5	186.8	96.1	111.9	116.6	21.8	21.4	78.7	14.7	11.7
	♂	10	108.8	181.1	97.6	116.0	118.7	21.8	22.6	87.3	13.7	11.6
Macaca mulatta	♀	17	97.4	68.2	99.5	111.5	111.1	20.4	19.2	71.3	15.7	14.2
	♂	7	110.4	72.8	99.0	111.6	112.9	21.8	21.4	73.6	16.7	16.2

Table 5 gives a comparison between some of the body proportions of adult proboscis monkeys and corresponding averages for adult langurs and macaques. From these data it is seen that the proboscis monkey has a relatively stouter trunk than either the langurs or the macaques. The tail of the proboscis monkey is proportionately much shorter than that of langurs and of the crab-eating macaque. The proboscis monkey is furthermore characterized by the relatively longest upper extremities, highest intermembral index and proportionately smallest outer ears. With the langurs the proboscis monkey has in common a comparatively small brainpart of the head and a broad interocular region, in contrast to macaques in which the approximation of the eyes has gone to a greater extreme. If the figures in table 5 are compared with the corresponding data for adult manlike apes and man, as published by the author in former papers (1933a and c, 1940a, 1941), it becomes very evident that the lower catarrhines are really remarkably uniform in most of their body proportions and are far removed in these respects from all the higher primates.

DEVELOPMENTAL CHANGES

Outer Body

The smallest fetus of *Nasalis* that has been briefly described is the specimen of Keibel (1906) with a crown-rump length of 25.2 mm. (see fig. 3). At this early stage of development the nose is already slightly more prominent than in other primate fetuses of corresponding age. The eyelids have not yet closed, the first signs of hair *anlagen* have appeared on the eyebrows, upper lip and chin. The tip of the tail bears a caudal filament, as it does also in the older specimen of Keibel and in the four youngest fetuses, studied by the writer. The youngest of the latter are the double-ovum twins, collected on the Asiatic Primate Expedition of 1937, with sitting-heights of 119 and 124 mm. respectively. In both these specimens skin color has appeared on the scalp (grey-brown), the already quite prominent nose (deep slate-blue), the digits (light brown) and, in the male, the perineal raphe (grey to blue), the rest of the body surface being still unpigmented. Of hair these two fetuses possess dark, long eyebrows and light as well as dark hairs on the upper lip and chin (fig. 3). Ischial callosities are already clearly indicated by sharply circumscribed, thickened zones overlying the ischial tuberosities. The outer ears are still of moderate size, the edge of the helix has not yet become rolled in, they bear a much more

marked Darwinian tubercle than persists later on, and they possess a definite lobule. The same conditions exist in the next older fetus with a sitting-height of 133 mm., except that very fine and short, dark hair has been added on the scalp, where it radiates from a center on the forehead and is directed straight back over the parietal and occipital regions. Even at this stage there are as yet no eyelashes. In another fetus, measuring 154 mm. in sitting height (fig. 3), the hair on the scalp has become very much longer, is parted on the forehead, and has assumed a reddish-brown color. The outer sides of the limbs and the back have acquired short, reddish hairs, of which there are fewer on the lower than on the upper extremities. In the older fetuses the hairy coat has been completed. It may also be mentioned that in all the fetuses examined by the author, as well as in the infants, the nose is conspicuous not only on account of its size and shape (fig. 3), but also by its deep blue color. Wiedersheim (1901a and b) had made the same observation on his fetus of *Nasalis*, but expressed the opinion that this blue color might be some *post mortem* change connected with preservation. This, however, is not the case since this color was clearly noticeable in the *fresh* fetuses, removed by the writer very soon after the death of the mother animal, and also in several *living* infants, observed in the field. Later during postnatal growth this blue color of the nose fades away to change to a more or less deep shade of brick-red, probably due to the high state of vascularization of this specialized structure. In adult proboscis monkeys there exists a very striking sex difference in the relative size of the outer nose, as is clearly shown by plates 1 to 3. The nose of the adult female has not developed far beyond the stage reached by all infants, but in adult males this organ is several times larger than in the young or in the fully grown female and the lower profile of the nose is horizontally directed, instead of forward as in the females. In old males, finally, the enormous nose may become somewhat longer yet and sag to an extent that it overhangs the mouth. Incidentally, the writer has never seen a proboscis monkey with as markedly bifid a nasal apex as claimed as typical and illustrated (diagrammatically) by Pocock (1926).

Among all the proboscis monkeys studied there occurred only one abnormal condition, noticeable on the outer body[1]. This is the case of an incomplete supernumerary digit which had developed as a grape-like appendage from the base of the terminal phalanx of the right

[1]Reference may here be made also to the case of unilateral cryptorchism, found in one adult of this series, in which one testis had been stunted in development and had failed to descend (Schultz, 1938 b).

second toe in an adult male specimen (Plate 4, D). A practically identical condition was found in an adult male langur from northern Siam (A. P. E. No. 121) in which there also existed a grape-like appendage, bearing dermatoglyphics, but in this case it had sprouted from the middle segment of the left second finger. This is the only incidence of this sort among 83 langurs of various species, examined by the writer. In macaques developmental abnormalities of the digits appear to be somewhat more common. In a total of 152 specimens, for which the writer has kept records, incomplete supernumerary digits of the same appearance as the just mentioned cases were found in a *Macaca irus* (ad. ♂, A. P. E. No. 427) on the basal phalanx of toe II and in a *Macaca mulatta* (ad. ♂, A. S. 1541) on the terminal phalanx of toe III. In another *Macaca irus* (ad. ♂, A. P. E. No. 369) there are small supernumerary digits on the basal phalanges of the right toes III and IV and in the left fourth toe the basal and middle phalanges had very incompletely developed, leaving this digit abnormally short. The latter condition is nearly duplicated in a juvenile *Macaca mulatta* of the Carnegie Colony, though in this case it is the fifth toe. In gibbons such manifestations of abnormal development are surprisingly common, as will be shown in a later publication.

Teeth

The sequence of eruption of the deciduous teeth of proboscis monkeys could be studied on the basis of the findings in the incomplete dentitions of five infants. The following sequence appears to represent the typical condition: upper middle incisors, lower lateral incisors, lower middle and upper lateral incisors, lower and upper first molars, lower canines, upper canines, lower second molars, upper second molars. This order of appearance differs only in some details from the sequence of eruption of the deciduous teeth of macaques in which all the incisors are also the first to appear, being followed after a considerable pause by the canines and first molars and, after a long resting period, by the second molars (Schultz, 1933 b). In orang-utan and chimpanzee, on the other hand, the canines are the last milk teeth to erupt (Schultz, 1940 a, 1941). Modern man stands in this respect much closer to the lower catarrhines than to the great apes.

The sequence of eruption of the permanent teeth of proboscis monkeys was studied by means of the dental formulae of 15 specimens, listed in table 6, considering also the degrees of eruption of particular teeth. The order of appearance of these teeth is as follows: lower first

Table 6

Dental formulae of 15 proboscis monkeys with incomplete permanent dentition, arranged to show the sequence of eruption of the permanent teeth. Seven of these cases are from former paper by the author (1935). u. = tooth of upper jaw, l. = tooth of lower jaw.

Specimens	*Dental Formula*	*Incompletely Erupted:*
3	i i c m m M / i i c m m M	In 1 case u. M1 (¼) and l. M1 (½)
1	i i c m m M / I i c m m M	l. I1 (½)
1	I – c m m M / I I c m m M	l. I2 (¾)
1	I I c m m M / I I c m m M	u. I2 (¼)
1	I I c m m M M / I I c m m M M	u. and l. I2 (¾) and u. M2 (½)
1 ♀	I I c m m M M / I I C m m M M	l. C (¼)
1 ♂	I I c P P M M / I I C P P M M	l. C (¼)
1 ♀ 1 ♂	I I C P P M M / I I C P P M M M	♀ = u. C (¾) and l. M3 (¼) ♂ = u. C (¼) and l. M3 (½)
2 ♀ 2 ♂	I I C P P M M M / I I C P P M M M	1 ♀ = l. M3 (½) and u. M3 (¼) 1 ♀ = u. M3 (½) 1 ♂ = l. & u. M3 (¾) and l. C (¾) and u. C (¼); 1 ♂ = l. C (¾) and u. C (¼)

molars, upper first molars, resting period, lower middle incisors, upper middle incisors, lower lateral incisors, upper lateral incisors, lower second molars, upper second molars, lower and upper first and second premolars in unknown, but probably very rapid and irregular succession, and finally, lower canines, upper canines, lower third molars, upper third molars in females, and lower third molars, upper third molars and lower canines (simultaneously), upper canines in males. This sequence agrees more closely with the corresponding conditions in macaques and baboons than with those in langurs, inasmuch as the second molars erupt after the incisors and the third molars after the premolars, instead of before, as in langurs (Schultz, 1935).

The type of occlusion of the incisors was noted in the freshly killed specimens and later again in their macerated skulls and this with identical results. In infants edge-to-edge bite occurred in 4 cases and underbite in 5 cases, in juveniles the former condition was found in 4 cases and the latter in 3 cases. Among adults edge-to-edge bite existed in 6 cases and underbite in 20 cases without any significant sex difference in this regard. Overbite did not occur at all in any of the proboscis monkeys examined, but it is very common among macaques and not rare in orang-utans and chimpanzees.

For the sake of completeness the abnormal and pathological conditions in the dentition of *Nasalis* are briefly recorded here. For this purpose the data on 48 specimens, used in a former study by the author (1935), have been combined with the records on the 42 new skulls, examined for this paper. There are no pathological or abnormal conditions in the dentitions of 9 infants and 14 juveniles. Among the 67 adults the lower left middle incisors are congenitally lacking (leaving no diastema) in 2 cases and crowding of teeth exists in 2 other cases, affecting the upper middle incisors, once bilaterally and once unilaterally. In the same series of adults no case of carious infection could be observed, but alveolar abscesses exist in 2 skulls (once on a premolar and once on a canine) and closed alveoli, following the loss of a tooth, are present in 2 other skulls (once upper r. and l. lateral incisor and once only the right one of these teeth). In comparing these notes with the author's (1940a, 1941) corresponding reports on orang-utans and chimpanzees, it will be strikingly apparent that abnormalities and diseased conditions of the dental apparatus are far more prevalent in these anthropoid apes than in the proboscis monkeys.

Skeleton

a. Spinal Column. The numbers of vertebrae in the different regions of the spinal column vary comparatively little in proboscis monkeys and certainly not nearly as much as in anthropoid apes. In the 46 specimens of *Nasalis*, for which the author has been able to collect the vertebral formulae, all have 7 cervical vertebrae. In 41 of these specimens the presence of absence of transverse foramina in the cervical vertebrae could be noted. These foramina occur in all cervical vertebrae, except in the seventh, where they exist bilaterally in 29 cases, unilaterally (on right side only) in 4 cases, and are completely lacking in the remaining 8 cases. In macaques these foramina are lacking in nearly all cases, in orang-utans in all cases, in chimpanzees in almost half the cases, but in man extremely rarely.

In the 46 *Nasalis* skeletons there are, on an average, 12.1 thoracic vertebrae, 13 occurring in 4 cases and 12 in all the other cases. In the specimens with 13 pairs of ribs the last pair is always very short, indeed, in two instances the thirteenth ribs are mere rudiments. The average number of lumbar vertebrae equals 6.9, 7 being present in 41 cases and only 6 in 5 cases. Six lumbar vertebrae combine with 13 thoracic ones in 4 instances and with 4 sacral vertebrae in the fifth case. Only in the latter case are there 18 thoraco-lumbar vertebrae[1] and in all the other specimens of this series there are 19 thoraco-lumbar vertebrae. This remarkable scarcity of numerical variations among the praesacral vertebrae of proboscis monkeys forms a striking contrast to the conditions in anthropoid apes in which these vertebrae vary to an enormous extent (Schultz, 1930). The average number of sacral vertebrae of the proboscis monkey is 3.1, the sacrum being composed of 3 vertebrae in 42 cases and of 4 vertebrae in the remaining 4 cases. One of the latter cases is shown in figure 4. This figure serves to illustrate also the extreme variations in the position of the sacrum in relation to the hip bones. In general, the sacrum is attached higher on the ilia in specimens with only 6 lumbar vertebrae than in those with 7, though even among the latter there exists considerable variability in this respect. An even greater variability in this relative position has been found in orang-utans in which it is also correlated to a considerable extent with the number of praesacral vertebrae (Schultz, 1941). The number of caudal vertebrae of proboscis monkeys averages

[1]Flower (1888) gives the vertebral formula of a *Nasalis* skeleton in the Royal College of Surgeons in London as 12 thoracic, 6 lumbar, 3 sacral, and 27 caudal vertebrae.

24.6 and varies between 23 (4 cases) and 26 (5 cases). The total number of vertebrae varies between 52 and 55, averaging 53.7. The typical vertebral formula of *Nasalis* reads: 7 cervical, 12 thoracic, 7 lumbar, 3 sacral, and 25 caudal vertebrae. The average vertebral formulae of nearly all other lower catarrhines are exactly the same, except of course in regard to the caudal region. This formula, disregarding the caudal region, occurred in 85 per cent of the proboscis monkeys. In the orang-

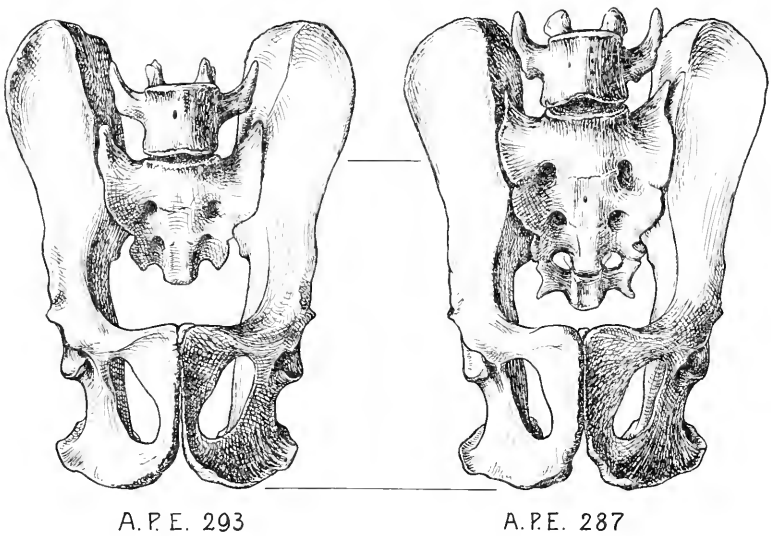

Fig. 4. Pelves of adult male proboscis monkeys: specimen on left has 7 lumbar and 3 sacral vertebrae, specimen on right 6 lumbar and 4 sacral vertebrae. Note difference in relative position of sacrum.

utan the typical formula for the praecaudal spine was found in only 24 per cent of the (105) specimens and each of the many different formulae is even less frequent (Schultz, 1941). The corresponding figure for chimpanzee[1] is 32.

The proportionate lengths of some of the various spinal regions undergo significant changes during growth in most primates, as has been shown in other studies by the author (1938 a, 1940 a, 1941), for which, however, no very young specimens of *Nasalis* had been avail-

[1]Based upon data on 77 chimpanzee skeletons, published by the author (1940 a).

able. Data for the latter have since been secured and are listed in table 7 together with figures from a previous paper by the writer (1938 a). The relative lengths of the cervical and thoracic regions become shorter with age and the lumbar region increases in its proportionate length. This is in complete agreement with the findings for the other primates. The relative length of the caudal portion of the spine reaches its maximum values during the infantile period of growth, as was to be expected from the identical age changes in the relative tail length, as measured on the outer body (table 1).

Table 7

Averages of the lengths of the various spinal regions (measured with tape on the ventral surface) in percentage of the trunk height in proboscis monkeys of different ages. From author's former paper (1938) and new data for fetus and for two small infants.

Age	*Specimens*	*Cerv.*	*Thor.*	*Lumb.*	*Thor.-Lumb.*	*Sacr.*	*Caud.*
Fetus	1	23.2	49.3	40.6	89.9	13.8	149.3
Infants	9	20.6	47.8	42.0	89.8	15.1	189.5
Juveniles	6	17.4	42.2	45.0	87.2	14.5	177.9
Adults	23	17.5	42.5	44.9	87.4	13.4	160.1

The available material permits the following observations and conclusions regarding the ossification of the vertebrae in proboscis monkeys: The two ossified lateral portions of the dorsal arches become united in the mid-line at birth or even sooner, though the dorsal processes remain cartilaginous for some time later. The only exception to this was found in the second largest infant, with complete and somewhat worn deciduous dentition, in which the dorsal arch of the atlas remained open (Plate 4, C). This is undoubtedly an anomaly and may be regarded as localized *spina bifida occulta*. The vertebral bodies and the dorsal arches are still separate in only the three youngest infants with incomplete first dentition. The bony union between these verte-

bral elements is complete at the time the last deciduous teeth have appeared, i. e., much earlier than in the orang-utan (Schultz, 1941). The odontoid process of the epistropheus becomes fused with the body of this vertebra at the age of eruption of the first permanent molars and the ventral arch of the atlas unites with the lateral portions of the first vertebra very soon afterwards, or also at a comparatively earlier age than in the orang-utan. The sacral vertebrae fuse late in the juvenile period, the first and second somewhat sooner than the second and third and the dorsal side before the ventral side. The epiphyseal plates of the vertebrae have completely fused with the vertebral bodies in only two old proboscis monkeys. In all the other specimens they are still separate at least in part of the thoracic region. These epiphyses close first on the caudal vertebrae, namely at the age of completion of the permanent dentition. During later adult life more and more of these plates fuse with the corresponding vertebral bodies and this apparently in an order starting simultaneously at the opposite ends of the praecaudal spine.

b. Sternum and Ribs. The length of the sternum (without xiphoid process) in percentage of the trunk height averages in proboscis monkeys 22.9 in 9 infants, 17.9 in 7 juveniles, 17.6 in 15 adult females, and 22.2 in 10 adult males. The sex difference in adults is significant as the index varies in the females between 15.0 and 21.3, whereas in the males between 20.0 and 25.3. The corresponding averages for adult orang-utans, chimpanzees and, particularly, man are considerably higher, indicating a proportionately longer sternum than in proboscis monkeys.

The number of pairs of ribs reaching the sternum could be recorded in 41 proboscis monkeys and this invariably as 7. In many other lower catarrhines 8 pairs are the rule. The slender sternum of the proboscis monkey ossifies from a number of centers, as shown in figure 5. Double centers in an intercostal space, frequent among higher primates, have never been seen in proboscis monkeys. The corpus sterni contains four centers in all infants and juveniles, but a fifth center may appear later, as it was found only among adults, namely in 12 out of 25 cases. Only in two old animals have some of these segments become partly fused, once the lowest two and once the lowest three segments. The xiphoid process is ossified in many specimens, containing a center already at birth (fig. 5), but remains permanently cartilaginous in a minority of the cases.

A separate epiphysis at the tubercle of the ribs disappears during juvenile life, but the epiphysis of the costal head remains at least

partly separate for a considerable time after the completion of the permanent dentition.

c. Hip Bone. According to X-ray photographs of the proboscis monkey fetuses the innominate bone has only its three primary elements ossified during prenatal development and these are still widely separate. Even the bony rami of ischium and pubis do not become closed until about the time of birth. At the junction of the pelvic elements in the hip joint there is a separate *os acetabuli* in 4 out of 7 juveniles. These elements fuse during the last brief phase of dental eruption, the pubis remaining separate slightly longer than the ilium and ischium,

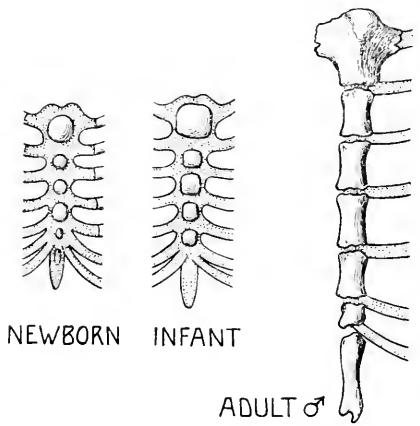

Fig. 5. The sternum in proboscis monkeys of different ages. Dotted areas = cartilage.

the acetabular lines of separation for the pubis being still visible in one fully adult specimen. This agrees very closely with the corresponding findings for the great apes (Schultz, 1941), but differs from these conditions in man in whom the pelvic elements fuse long before the second dentition is completed. The epiphyses on the ischial tuberosities loose their separate existence early in adult life, but the bony rims on the iliac crests remain separate, at least in their middle portions, for a considerable time after adulthood has been attained. The pubic symphysis was found open in all specimens, except one old male in which it had become solidly closed along its uppermost third.

d. Shoulder Girdle. The sternal epiphysis of the clavicle does not become fused until adult life. It is uncertain just when it does close in

relation to other happenings in skeletal development, as it was closed in one adult before many epiphyseal lines on limb bones had disappeared, but was still open in several other adults with all the epiphyses of the limb bones closed.

The coracoid process of the shoulder-blade develops an ossification center shortly before birth. This process remains separate until the second dentition is completed. A separate bony epiphysis on the acromial process does not always disappear until somewhat later, i. e., in adults with noticeable attrition of the teeth. The vertebral border of the scapula is mainly cartilaginous in all juveniles and the lower angle remains cartilaginous throughout life. Finally, it may be mentioned here that one adult male proboscis monkey possesses very pronounced scaphoid scapulae.

c. Limb Bones. The first ossification center to appear in the epiphyses of the long bones of the limbs is the one for the distal epiphysis of the femur which is already of considerable size at birth (fig. 6). It is very remarkable that no other epiphyses of the limb bones have developed ossification centers in the newborn proboscis monkey, since most of these centers are already present in newborn macaques (Schultz, 1937). In a proboscis monkey infant with merely the second milk molars lacking, ossification centers have appeared in the epiphyses of the long bones, except the medial epicondyle of the humerus, the proximal epiphysis of the radius, both epiphyses of the ulna, the trochanters, and the proximal epiphysis of the fibula. Of all the latter epiphyses, that at the proximal end of the radius develops first an ossification center, namely as soon as the deciduous dentition is complete. Slightly later the center for the great trochanter is added, then those for the medial epicondyle and the proximal epiphysis of the fibula, to be followed by a center for the small trochanter and last by one for the proximal epiphysis of the ulna which was still absent even in two specimens from the beginning of the juvenile period. The epiphyses of the metatarsi, metacarpi and phalanges develop centers in early infantile life (fig. 6), but the epiphysis of the tuber calcanei does not become ossified until the first permanent molars have erupted. In the patellae ossification centers appear toward the end of the infantile period.

The first of the epiphyses to become solidly united with the shaft of the bone is the distal epiphysis of the humerus which disappears as a separate element just before the permanent dentition is completed. After an appreciable interval the medial epicondyle of the humerus and the proximal epiphysis of the ulna fuse with the shafts of the bones.

Table 8. Sequence of epiphyseal union in the proboscis monkey, orang-utan, chimpanzee and man (for further details concerning the later primates see Schultz, 1941) "Acetabulum" refers to union of the three primary elements of the hip bone. Union of the items in the separated groups occurs at practically the same ages or in rapid succession.

Proboscis Monkey	*Orang-utan*	*Chimpanzee*	*Eskimos & Indians Stewart, 1934*	*White & Todd, 1933*
Humerus dist.	Humerus dist.	Humerus dist.	Humerus dist.	Acetabulum Humerus dist.
Acetabulum Coracoid process	Ulna prox. Med. epicondyle Calcaneus	Med. epicondyle Ulna prox. Calcaneus	Ulna prox. Acetabulum Coracoid process	Ulna prox. Calcaneus
Ischial tuberosity Med. epicondyle Ulna prox. Calcaneus	Femur head Trochanters Radius prox.	Trochanters Femur head	Radius prox.	Metatarsi Radius prox.
Trochanters Femur head Radius prox.	Fibula dist. Tibia dist.	Radius prox. Tibia dist. Fibula dist.	Med. epicondyle Calcaneus	Med. epicondyle
Tibia dist. Fibula dist.	Fibula prox. Tibia prox. Acetabulum Coracoid process	Femur dist. Metacarpi Metatarsi Acetabulum Coracoid process	Femur head Trochanters	Tibia dist. Fibula dist. Metacarpi
Metatarsi Metacarpi Tibia prox. Fibula prox. Femur dist.	Femur dist. Metatarsi Metacarpi	Tibia prox. Fibula prox.	Tibia dist. Fibula dist.	Femur head Trochanters
Ulna dist. Radius dist. Humerus prox.	Humerus prox. Radius dist. Ulna dist. Ischial tuberosity	Radius dist. Ulna dist. Humerus prox. Ischial tuberosity	Tibia prox. Fibula prox. Femur dist. Ischial tuberosity Radius dist. Ulna dist. Humerus prox.	Tibia prox. Fibula prox. Ulna dist. Femur dist. Humerus prox.
Clavicle (?) Iliac crest	Iliac crest Clavicle	Iliac crest Clavicle	Iliac crest Clavicle	

The further, detailed sequence of epiphyseal union in the proboscis monkey is shown best in table 8 where some other, previously discussed items of skeletal development have been inserted. From the preliminary comparison of these conditions in *Nasalis* with those in a few other primates, as far as known, it becomes apparent that, in general, there seems to prevail one ground plan for the sequence of these osteological happenings. More than detailed exceptions are found chiefly in regard to the order of fusion in the coracoid process,

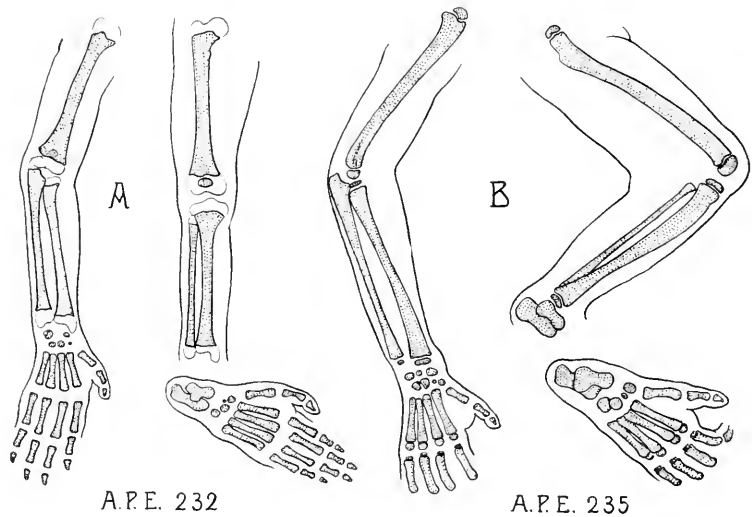

Fig. 6. Tracings of X-ray photographs of the limbs of infant proboscis monkeys. A = practically "newborn" (not over two weeks old), B = completed deciduous dentition (M1 nearly ready to erupt).

ischial tuberosity and the primary pelvic elements, which stand near the top of the list for *Nasalis,* whereas far down in the lists for the great apes and high *and* low in the list for man. It must be mentioned here that most of the items listed in table 8 fuse after the completion of the permanent dentition in the monkey and the apes, whereas in man nearly all the items have already fused at that stage of dental development. Further comments on these significant problems are best postponed until the corresponding data on many other primates have been fully recorded.

f. Skull. In a newborn proboscis monkey the great or bregmatic

fontanelle is still wide open, extending far forward between the frontal bones. This is quite surprising inasmuch as these fontanelles are either diminutive in size or else already closed at birth in macaques, chimpanzees and orang-utans (Schultz, 1937, 1940 a, 1941). The lambdoid and pteric fontanelles are closed in all infant proboscis monkeys, but the asteric or mastoid fontanelles are of considerable size at birth and their lower portions, near the lateral occipitals, remain open throughout the infantile period, i. e., long after the bregmatic fontanelle has disappeared. Indeed, in one adult *Nasalis* both mastoid fontanelles have failed to close as a developmental anomaly (Plate 4, B). The pteric fontanelles are closed in fetal life in such a fashion that the alisphenoid meets the parietal, thus keeping the temporal squama from meeting the frontal. This arrangement existed in all 38 *Nasalis* in which the sutures of the pteric region had not yet become obliterated (see fig. 7).

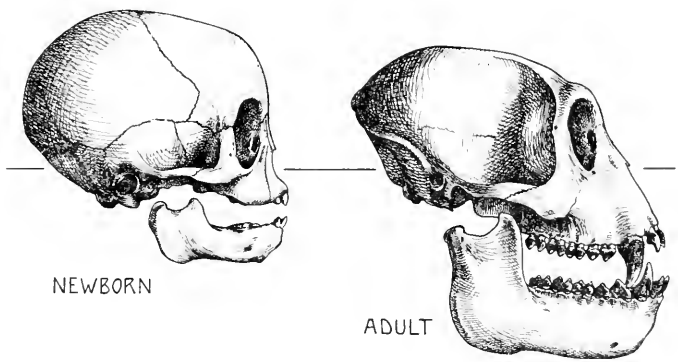

Fig. 7. Side views of skulls of proboscis monkeys, posed in ear-eye horizon, reduced to same skull length (from glabella).

Of other notes on early cranial development in *Nasalis* the following are here recorded: A cranio-pharyngeal canal, present in all embryos, did not persist to postnatal life in a single case, though it is found in many other primate skulls. The mandibular symphysis is still open in a newborn and one infant, lacking its second molars, but it is closed in all other infants including two with incomplete first dentition. The temporo-mastoid sutures disappear very soon after birth. The interfrontal or metopic suture is entirely open in the two youngest infants and is partly open in 6 out of 7 other infants, closure beginning invariably in the middle portion of this suture. In exceptional cases the

metopic suture can persist beyond the infantile period. This has happened in one juvenile (A. P. E. No. 248) with complete metopism and in an adult female (U. S. Nat. Mus. No. 196792) among the *Nasalis* skulls examined by the author. Another abnormal suture was found in one adult proboscis monkey, namely a perpendicular suture dividing the right and the left zygomatic bone (Plate 4, A). The occipital elements are separate in all infants and fused in all juveniles, i. e., the basioccipital, the lateral occipitals and the occipital squama become solidly joined at the time of eruption of the first permanent molars. This agrees perfectly with this condition in the great apes and in man (Schultz, 1941). All the other sutures remain open until at least the beginning of adulthood. The sequence of suture closure is difficult to determine since there exists little detailed consistency, as shown by the data in table 9. All that can be concluded from the available material is that the lambdoid and sagittal sutures generally close before the coronal and basilary sutures, and that the coronal suture is closed only in old animals with an advanced degree of attrition of the teeth.

Of the remaining sutures it may here be mentioned that the occipito-mastoid sutures are closed in only one instance, an old animal. The sutures of the palate are open in all cases, except two in which the sagittal palatinal suture had become obliterated. The facial portions of the intermaxillary sutures are completely closed in only two old males; in four other males and one adult female these sutures had started to close at their lower ends. The internasal suture, which closes before birth in macaques (Schultz, 1937), is still entirely open in 12 adult proboscis monkeys, partly open in 6 other adults, and completely closed in only the remaining 8 adults. Generally speaking, it can be claimed that obliteration of the cranial sutures occurs comparatively late in life in *Nasalis* in contrast to many other Old World monkeys and apes. Fontanellar and Wormian bones are completely lacking in *Nasalis* skulls.

g. Pathological Conditions of the Skeleton. In conclusion it must be mentioned as part of the age changes in proboscis monkeys that pathological conditions become much more frequent as the animal gets older. This has already been demonstrated in regard to the dentition. In the skeleton the following pathological conditions have been noted: Among 9 infants there is one partly healed fracture of a clavicle (Plate 4, I). Among 7 juveniles the acromial process of one specimen was fractured at the base and had become fairly well healed. Among 25 adults repaired fractures occurred in the following cases: 1. ilium (Plate 4, G); 2. clavicle; 3. scapula (Plate 4, F) and one rib (also long

exostosis on shaft of r. femur); 4. corpus sterni, r. humerus and l. ulna; 5. three ribs; 6. two ribs; 7. r. patella (Plate 4, H) (also exostoses on r. femur and tibia and corroded surfaces of r. knee-joint). In addition disease processes were evident in two specimens: 8. arthritic exostoses on many vertebrae (Plate 4, E); 9. exostoses and porous, irregular surface on corpus sterni and on proximal joint of l. tibia. These nine specimens with manifestations of one or several skeletal injuries in each constitute 36 per cent of the total series of 25 skeletons of adult wild proboscis monkeys. Healed fractures alone occur in 28 per cent of the adults, a frequency which is below that (33) found in adult orang-utans or that (36) in adult gibbons (Schultz, 1941).

Table 9

The status of closure of the main cranial sutures in 26 adult proboscis monkeys. *=advanced attrition of the teeth.

Specimens	*Basilary*	*Coronal*	*Sagittal*	*Lambdoid*
9	open	open	open	open
1	open	open	½ closed	open
1	open	open	closed	open
1	open	open	open	closed
1	open	open	½ closed	closed
1	open	open	closed	½ closed
3*	open	closed	closed	closed
1	closed	open	open	open
2	closed	open	open	closed
1*	closed	½ closed	closed	closed
1*	closed	closed	closed	½ closed
4*	closed	closed	closed	closed

SUMMARY

This paper represents chiefly a record of the conditions of growth and development in the proboscis monkey (*Nasalis larvatus*). Such a contribution will gain in significance and interest only when all its new data can be compared with corresponding information on the ontogenetic processes in representatives of many other groups of

primates. Such information, based upon adequate material, is as yet extremely limited, so that general comparisons must unfortunately still be postponed.

The series of proboscis monkeys studied consist of 51 bodies, ranging in age from the middle of fetal to adult life. In 41 of these specimens the skeletons could be investigated. An additional 2 skulls could be examined and the observations on the dentition have been augmented by the author's data for a former study on 48 specimens.

The body weight of proboscis monkeys equals 0.45 kg. at birth, 9.87 kg. in adult females and 20.34 kg. in adult males. The birth weight amounts to 4.6 per cent of the weight of fully grown females; the corresponding figure for macaque is 6.7 and that for man 5.5. Proboscis monkeys do not seem to become pregnant until their second dentition is completed. All available evidence indicates that there is no breeding season. One of the animals contained double-ovum twins.

The trunk of the proboscis monkey becomes more slender during growth, but in old males it becomes stouter again. The relative shoulder breadth decreases in general with age and the relative hip breadth changes little ontogenetically. The diameters of the pelvic inlet are proportionately larger in adult females than in adult males. The chest becomes slightly broader in relation to the chest depth during growth, but it remains always proportionately narrow in comparison with the chests of all higher primates. The spinal column reaches somewhat farther into the thoracic cavity in adults than in infants, but at no age nearly as far as it does in the higher primates. The length of the tail in percentage of the trunk height increases during the fetal and infantile periods and decreases again thereafter.

The rates of growth of the lengths of the limbs and the height of the trunk alternate with advancing age, the limbs growing faster than the trunk in fetal and infantile life and more slowly thereafter. In general the lower limbs grow somewhat faster than the upper ones and the distal limb segments faster than the proximal ones. The hands and feet become more slender during growth and the thumb proportionately shorter. The fourth digits surpass the second ones in length at all ages.

The average head diameter in its percentage relation to the trunk height decreases from 49 in fetuses to only 17 in adults. The cranial capacity averages in proboscis monkeys 70 cc. in infants, 83 cc. in juveniles, 85 cc. in adult females, and 102 cc. in adult males. In its percentage relation to body weight this capacity averages 7.0 in infants, 2.2 in juveniles, 0.9 in adult females, and 0.5 in adult males.

These relative cranial capacities of *Nasalis* do not differ significantly from those of langurs and macaques of corresponding weight.

The face grows more slowly than the trunk, but more rapidly than the brainpart of the head. The latter grows more intensively in length than in breadth and height and the face increases much more in height than in width. The relative distance between the eyes decreases during the early periods of growth, but increases again later in life, particularly in males. The proportionate size of the outer ears reaches its maximum in infants and becomes smaller again in older animals.

Proboscis monkeys have stouter trunks, relatively longer upper extremities and proportionately smaller outer ears than have langurs and macaques.

The conditions of fetal development regarding skin color, hair, configuration of outer ears and of nose are briefly recorded. The highly specialized, large nose is already conspicuous in fetuses and becomes many times larger in adult males than in adult females.

The deciduous teeth of proboscis monkeys erupt in the following order: upper i1, lower i2, lower i1 and upper i2, lower and upper m1, lower c, upper c, lower m2, upper m2. This sequence is nearly the same as in the macaque and quite similar to that in man, but differs significantly from the corresponding conditions in the great apes. The permanent teeth make their appearance in the following order: lower M1, upper M1, resting period, lower I1, upper I1, lower I2, upper I2, lower M2, upper M2, lower and upper P1 and P2 (in rapid and variable succession), and finally: lower C, upper C, lower M3, upper M3 in females and: lower M3, upper M3 and lower C, upper C in males. Underbite occurs more often than edge-to-edge bite and overbite is unknown in proboscis monkeys.

The typical vertebral formula for *Nasalis* is: 7 cervical, 12 thoracic, 7 lumbar, 3 sacral, and 25 caudal vertebrae. This formula existed in 85 per cent of the cases, indicating a comparatively high degree of stability. The only numerical variations found are the following: 13 thoracic, 6 lumbar, 4 sacral, and 23, 24 and 26 caudal vertebrae. Transverse foramina in the seventh cervical vertebra exist bilaterally in only 63 per cent of the cases. The relative lengths of the cervical and thoracic regions become shorter during growth and the lumbar region increases its proportionate length, just as in the other primates studied so far.

Many detailed happenings in skeletal developments have been recorded systematically; they are too numerous and diversified to be repeated here even in condensed form. The sequence of epiphyseal

union is shown in a summarizing manner in table 8, where these conditions in proboscis monkeys are compared with those in some other primates. It appears that most of the epiphyseal lines become closed in an order which is approximately the same in the few primates for which information is available and that in *Nasalis* such fusion takes place mostly after the completion of the permanent dentition.

At birth skeletal maturation has not progressed nearly as far in the proboscis monkey as in the macaque. For instance, only one ossification center (femur, distal) has as yet appeared in all of the epiphyses of the long bones in the newborn *Nasalis* and the bregmatic fontanelle is still wide open.

The lambdoid and sagittal sutures generally close after the completion of the second dentition, but before the basilary and coronal sutures become obliterated. The coronal suture can remain open until old age. The internasal suture does not close until some time after adulthood has been attained, whereas in macaques it closes before birth.

Disturbances in normal development, common among higher primates, are found in proboscis monkeys in comparatively few instances, of which the following are most noteworthy: congenitally lacking lower middle incisors, incomplete supernumerary digit, unilateral cryptorchism, divided zygomatic bones, failure to close of dorsal arch of atlas, of asteric fontanelles and of metopic suture.

Pathological conditions were found among wild proboscis monkeys in only two young specimens (healed fractures), but in a very considerable percentage of adult animals, namely two cases with alveolar abscesses, seven cases with one or more healed fractures, and four cases with arthritic and other exostoses, etc.

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PLATE 1

PLATE 1

Face of an adult female proboscis monkey. This and the following two figures by Prof. M. Brödel.

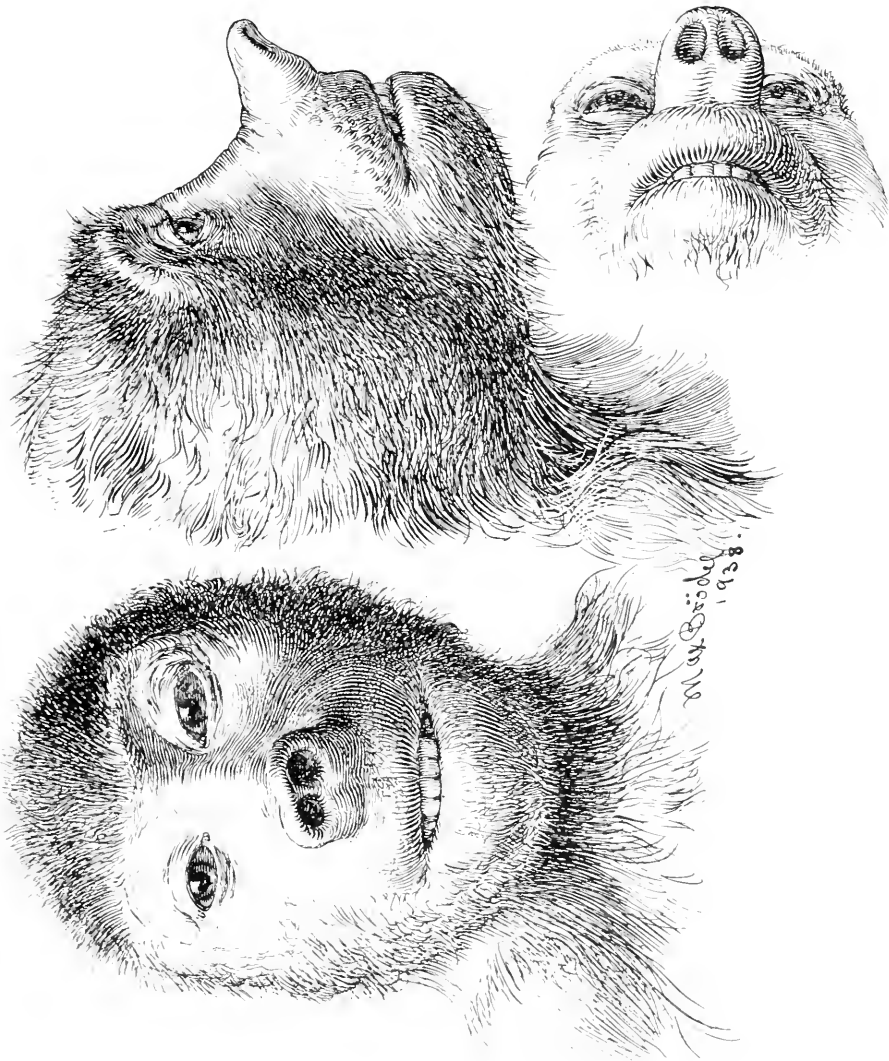


PLATE **2**

PLATE 2

Face of an adult male proboscis monkey (with little wear of teeth).

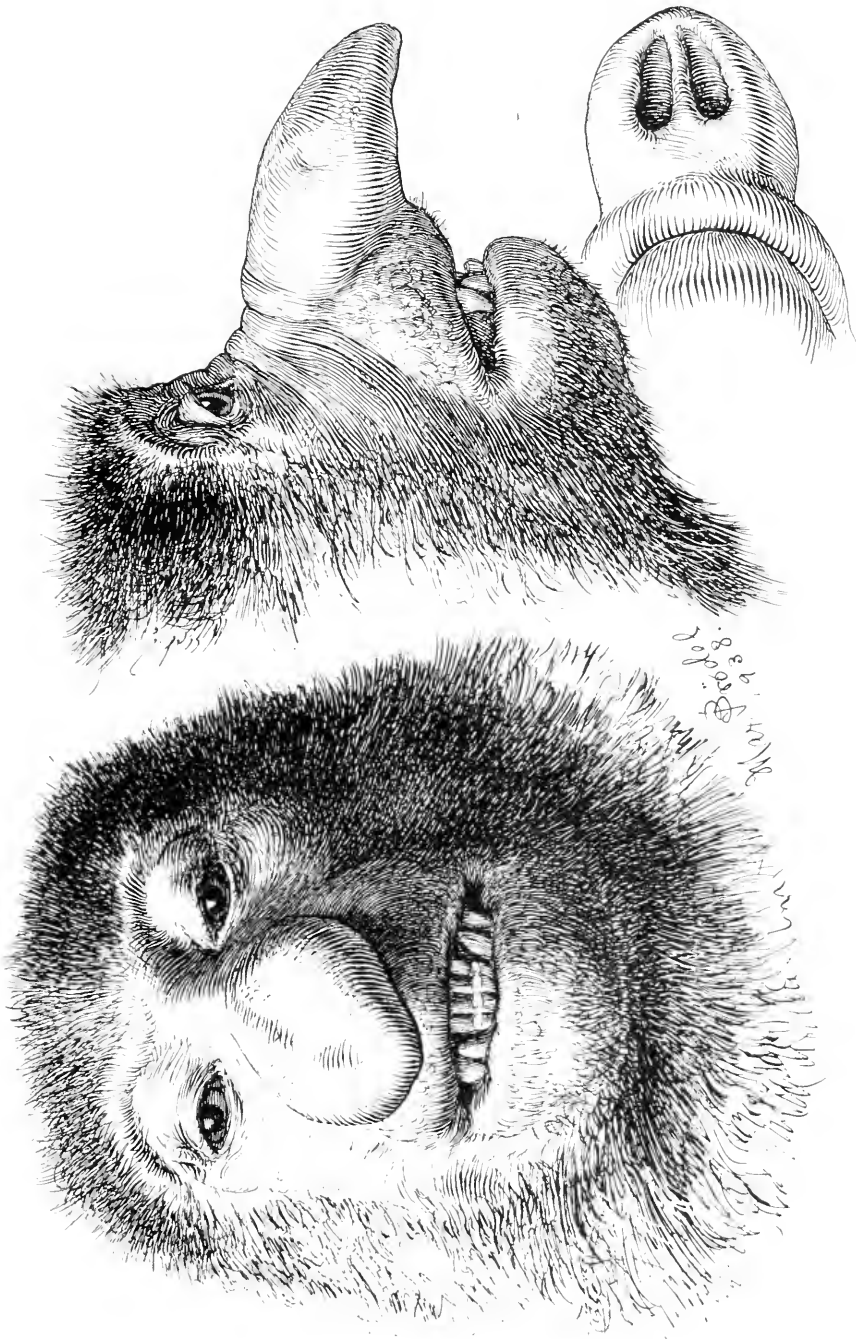


PLATE **3**

PLATE 3

Face of an old male proboscis monkey (with very marked wear of teeth).

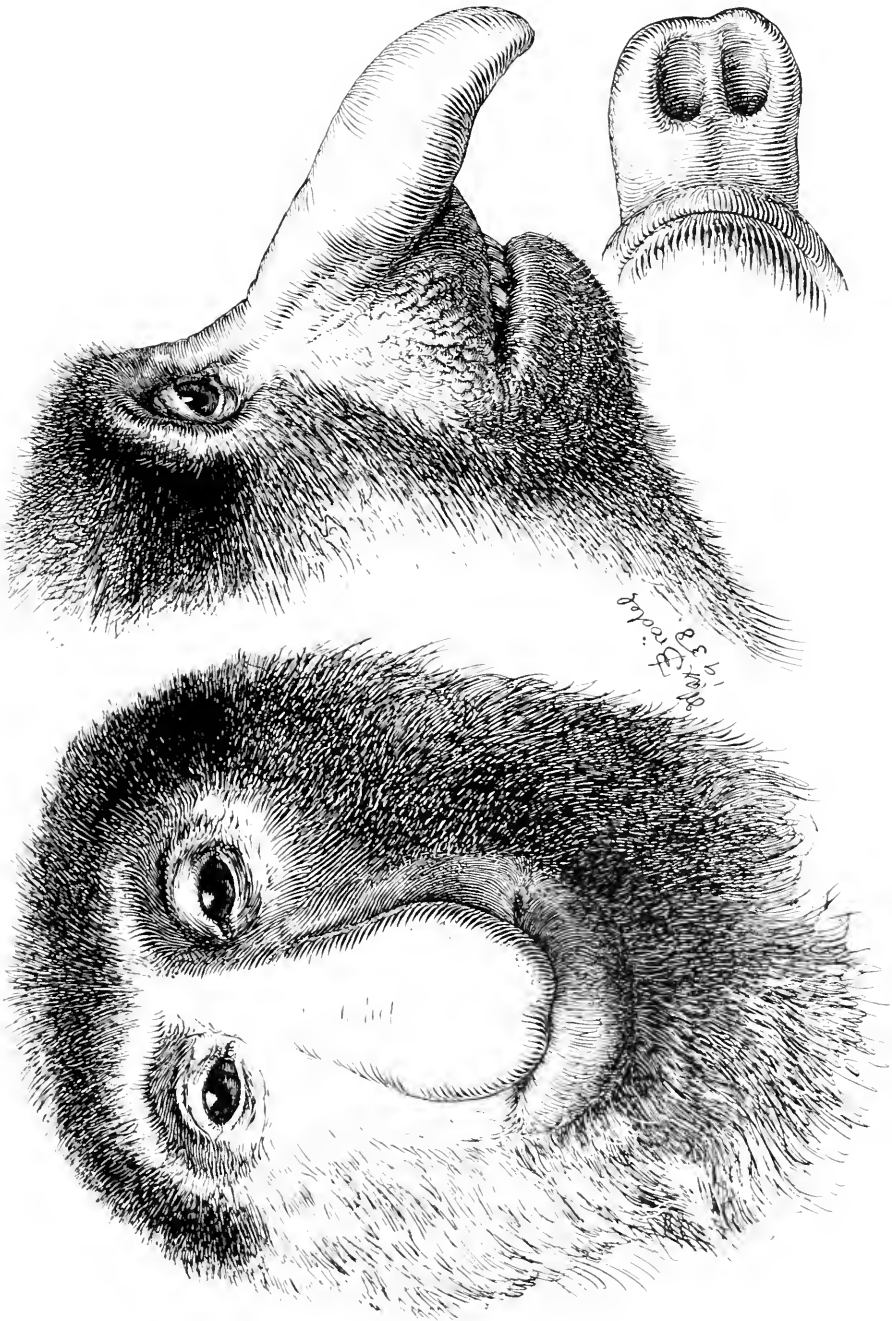
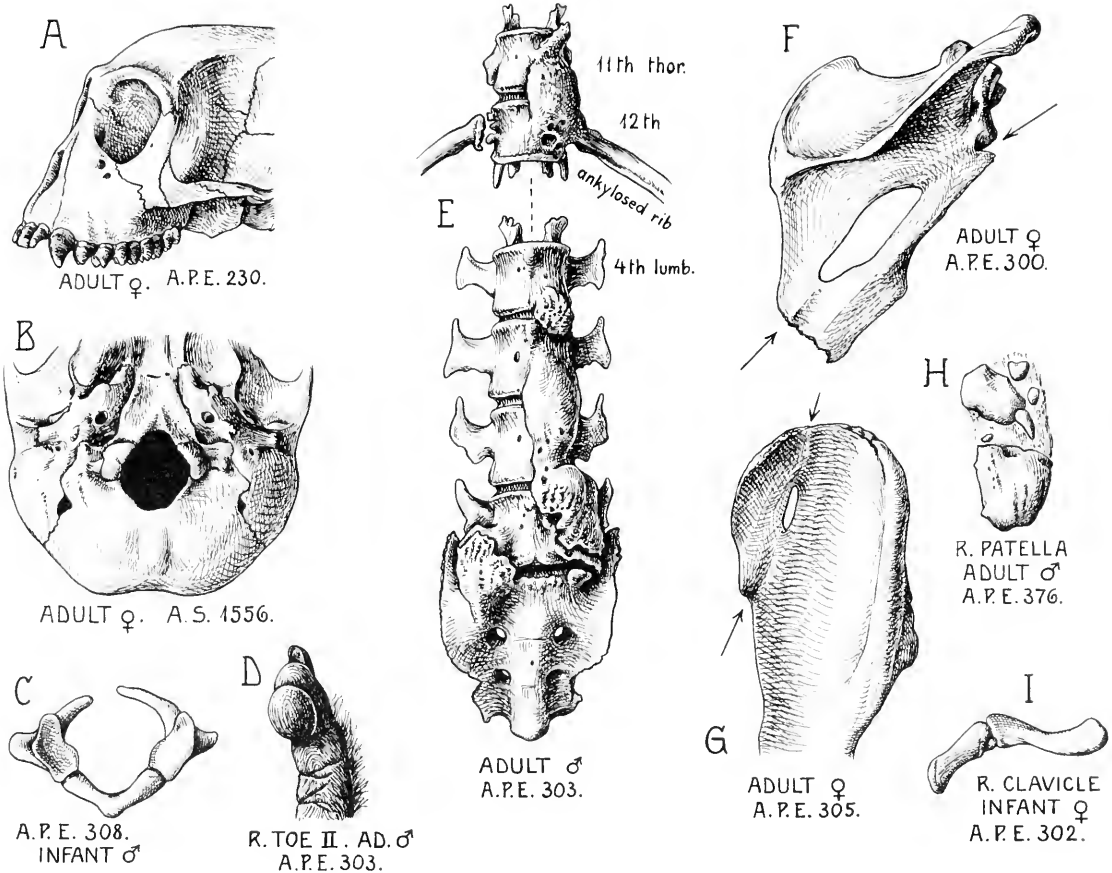


PLATE 4

PLATE 4

Congenital abnormalities and pathological conditions in wild proboscis monkeys. A = divided zygomatic bones; B = open occipito-mastoid fontanelles; C = open dorsal arch of atlas; D = incomplete supernumerary digit; E = arthritic exostoses on spinal column; F = healed fracture of r. scapula; G = healed fracture of l. ilium; H = fractured patella; I = partly healed fracture of r. clavicle.


A
ADULT ♀. A.P.E. 230.
B
ADULT ♀. A.S. 1556.
C
A.P.E. 308.
INFANT ♂
D
R. TOE II. AD. ♂
A.P.E. 303.
11th thor.
12th
ankylosed rib
E
4th lumb.
ADULT ♂
A.P.E. 303.
F
ADULT ♀
A.P.E. 300.
G
ADULT ♀
A.P.E. 305.
H
R. PATELLA
ADULT ♂
A.P.E. 376.
I
R. CLAVICLE
INFANT ♀
A.P.E. 302.

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NOTES ON THE SPIDERS OF THE VIRGIN ISLANDS

BY ELIZABETH B. BRYANT

WITH THREE PLATES

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No. 7 — *Notes on the Spiders of the Virgin Islands*

By Elizabeth B. Bryant

The Virgin Islands, a group of small islands in the West Indies, lie south and east of Puerto Rico. The fifty or more islands cover approximately two hundred and fifty square miles. The largest, St. Croix, St. Thomas and St. John, have been inhabited for many years, and at times have been intensively cultivated.

The first comprehensive study made of the Virgin Island spiders was by Dr. Alexander Petrunkevitch, whose "Spiders of the Virgin Islands" was based on a collection made by himself in September, 1925, and one made by Dr. Clarence R. Shoemaker in 1915. These two collections contained thirty-five species, of which eleven were described as new, eight from the Shoemaker collection. Twelve species had been recorded by earlier writers. Some of these have been found since on other islands, but four have never been recognized again. Of these four, three were described by C. Koch in "Die Arachniden", 1836–1848, *Mygale drassiformis*, *Evophrys vetusta* and *Marpissa incerta*. The descriptions are vague and the figures are poor, so unless the type specimens are still in existence, the species will probably remain unidentifiable. The fourth, *Trochanteria ranuncula* Karsch, 1879, was in a paper of descriptions of miscellaneous spiders, mostly from the far east, with the locality, "Sta. Cruz." The species has never been found since, and it is possible that it is from another place of the same name.

Aside from miscellaneous material, the Museum of Comparative Zoölogy has two collections of spiders from the Virgin Islands. The first was received from Dr. C. R. Wilson in 1922, while he was at the United States Experiment Station, St. Croix. It is a small collection, but each specimen has complete data. The second collection was received recently from Harry A. Beatty of Christiansted, St. Croix. The specimens are from that island. It contains a large number of very small spiders that are usually overlooked by casual collectors. The Wilson and Beatty collections contain sixty-eight species, seventeen of which are new. So today the list of Virgin Island species numbers ninety-three, including the four uncertain ones. Although obviously not exhaustive, since all collections have been from the three largest islands only, we now have a substantial basis for a study of the spider fauna of the island, and its comparison with those of other islands of the West Indies.

Of the sixty-nine species that have been examined, forty-six are found in Puerto Rico. This is not unexpected, as Puerto Rico is the nearest large island, and its spider fauna has been studied recently by Dr. Petrunkevitch. Some of these Puerto Rico species are common house spiders and were probably introduced by commerce, as they are found in warm areas over the world. Others are confined to the New World and four are known only from these two West Indian island groups, though an extended survey of adjacent islands may show that they are more widely distributed.

The only other island of the Lesser Antilles that has been intensively collected is St. Vincent, with about the same area as that of all the Virgin Islands combined. It is directly west of Barbadoes and much nearer to South America. H. H. Smith, a well known entomological collector, was sent there by a joint committee of the British Museum and the British Association for the Advancement of Science, and his spider collection was divided between M. Simon and the Peckhams. The latter described the family *Salticidae* and the results were published in the Proc. Zool. Soc. London in 1893. Fourteen species were recognized, of which twelve were new. Simon described the other families in three papers in the same publication in 1891, 1894 and 1897. The two authors recorded one hundred and forty-nine species in all, of which ninety-six were new.

Of these one hundred and forty-nine species found on St. Vincent, twenty-seven have been taken on the Virgin Islands. Possibly ten genera are common to the two groups, each represented by an indigenous species.

About the same time that Simon was working on the St. Vincent fauna, he was studying collections made by himself at several places in Venezuela, and he found several genera common to the two places. This was especially noticeable in the very small spiders of the family *Oonopidae*. In a few cases, the same species was found in both places, and have since been found to be widespread. It is curious that none of these species have been found in the Virgin Island collections. Among other small species, Simon described a new genus, *Thallumetus*, (*Dictynidae*), on males found at several places in Venezuela. Later, he described two more species from Chile in the same genus. Among the very small species in the Beatty collection from St. Croix, are males and females of this genus, the first time it has been recorded outside South America.

In conclusion, I especially wish to express my gratitude to Mr. Nathan Banks for his unfailing interest and help in preparing this

paper, and to Dr. Clarence R. Shoemaker, who so kindly made possible the examination of certain Petrunkevitch types in his collection. Thanks are also due to Dr. W. J. Gertsch, who kindly sent me drawings of a type in the American Museum of Natural History.

The following spiders from the Virgin Islands have been seen by me. The sex and the type locality follows the original description.

Sub-order MYGALOMORPHAE

Family THERAPHOSIDAE

Genus CYRTOPHOLIS Simon 1892

CYRTOPHOLIS PELUS Chamberlin

Cyrtopholis pelus Chamberlin, 1917, p. 42, pl. 2, figs. 8–10. "♀ St. Thomas"

Sub-order ARACHNOMORPHAE

Family FILISTATIDAE

Genus FILISTATA Latreille 1810

FILISTATA HIBERNALIS Hentz

Filistata hibernalis Hentz, 1842, p. 227, pl. 8, fig. 6; reprint, p. 23, pl. 2, fig. 6. "♀ South Carolina on the sea coast"; Petrunkevitch, 1926, p. 27.
♀ s St. Croix, (Wilson, Beatty)

Family OONOPIDAE

Species of the family Oonopidae are found in the dry vegetable detritus in warm countries. Even adults are very small. The largest species known is only 4.0 mm. and the smallest is less than a millimeter. Very few are found in temperate zones, and because they are so small, they are easily overlooked by the casual collector. Few species were known before the collection from St. Vincent was made by H. H. Smith. Simon proposed eight new genera for thirteen new species. One Old World genus was recognized, as well as one species described by Keyserling from Colombia. Among them, Simon found several that he had collected a few years before in Venezuela. Most are based on both male and female.

Whether extensive collections from the various islands of the West Indies will show that many of the genera are endemic is uncertain. Dr. Petrunkevitch found five species on Puerto Rico. Two of these

occur on St. Vincent, *Ischnothyreus peltifer* and *Heteroonops spinimanus*. Of the other three, one female was so unusual that a new genus was erected for it, and the two others belong to genera found on St. Vincent, *Opopaea* and *Stenoonops*. Eight species have been reported from Cuba, of which four are common to Puerto Rico, *Oonopinus minutissimus, Heteroonops spinimanus, Ischnothyreus peltifer* and *Opopaea lutzi*. For the remaining four, it was necessary to establish two new genera for two species, another belonged to the widespread genus *Opopaea*, and the fourth to the genus *Tetrablemma* O. P. Cambridge, 1873, based on a male from Ceylon.

The collection made by Beatty is unusually rich in specimens of this family, but strangely, it has none of the species reported from Puerto Rico, Cuba or St. Vincent.

Both keys to the family *Oonopidae* in the Histoire Naturelle des Araignées are full of inaccuracies and are very confusing to use. Also, the adjectives "high" or "low" in referring to the cephalothorax are misleading until enough specimens have been handled to distinguish between the two extremes. As Simon states in a footnote, the same characters are often found in the two sections of the family, (the hard and the soft bodies) and it is questionable if the possession or lack of a dorsal shield on the abdomen is of generic value, especially as it is a character that is sometimes wanting in the females. (Compare *Ceraticelus, Linyphidae*).

The relative size and position of the eyes, possession of spines on the anterior legs, the elongate patellae of the anterior legs, and the globose or elongate coxae, seem to be characters that are constant in both male and female.

Key to the genera of OONOPIDAE *of the Virgin Islands*

1 Abdomen with no dorsal shield 2
Abdomen with dorsal shield 4
2 Anterior tibiae and metatarsi with paired ventral spines, ♀ ; p.l.e. separated from p.m.e. . . . . *Telchius*
Anterior tibiae and metatarsi not spined 3
3 Cephalothorax rather low, posterior row of eyes cover less than half width of head, p.m.e. a broad oval . . . . . *Oonopinus*
Cephalothorax high, posterior row of eyes cover width of head, p.m.e. a narrow oval . . . . . *Stenoonops*
4 Anterior tibiae and metatarsi with paired spines . . . . . *Dysderina*
Anterior tibiae and metatarsi not spined 5

5 Ventral scutum about square, followed by a very narrow scutum, (♀), anterior patellae elongate and flattened dorsally. *Scaphioides*
Ventral scutum extends beyond middle 6
6 Abdomen cylindrical, ventral scutum extends beyond the middle, no inframammillary scutum, legs long . . . . . *Hytanis*
Abdomen flattened, ventral scutum extends almost to spinnerets, small inframammillary scutum, legs short . . . . . *Gamasomorpha*

Genus Stenoonops Simon 1891

Stenoonops nitens spec. nov.

Figures 5, 10

Male. Length, 1.3 mm.

Cephalothorax deep yellow, granular, so that lateral margins are roughened, high, posterior fifth falling abruptly to margin, four-fifths as wide as long, anterior margin narrow, posterior margin truncate; *eyes* almost cover width of head, all eyes heavily ringed with black, a.l.e. round, separated by a line, largest of the six, posterior row slightly recurved, eyes touching because of black rings, p.m.e. elliptical, twice as long as wide and touching for some distance, p.l.e. round, little more than short diameter of p.m.e.; *clypeus* convex, about equal to diameter of a.l.e.; *mandibles* small, weak and cone-shaped; *labium* wider than long, fused to sternum; *maxillae*, distal half much narrowed and inclined over labium; *sternum* two-thirds as wide as long, margin strongly lobed between coxae with a distinct lump opposite each coxa, tip pointed, IV coxae separated by more than a diameter, all coxae sub-globose; pedicel rather long; *abdomen* flesh-color, oval, smooth and shining with a slight iridescence, epigastric scutum faintly marked, spinnerets long, a pair of dark sacs beneath the skin separated by their diameter just anterior to spinnerets; *legs*, 4–1–2–3, varying little in length, no spines and rows of fine hairs, anterior patellae slightly elongate; *palpus*, pale, large, femur slender, patella and tibia sub-equal, little longer than diameter, cymbium and bulb united, with a few slender hairs on dorsal half and two very slender points at tip.

Female. Length, 1.4 mm.

Same as male; epigastric scutum not very distinct but the dark sacs anterior to spinnerets more distinct.

Holotype ♂ St. Croix, (Beatty)
Allotype ♀ St. Croix, (Beatty)
Paratypes 3 ♂ 1 ♀ St. Croix, (Beatty)

Stenoonops nitens differs from the genotype in its smaller size and the slightly recurved posterior eye row, but it agrees with it in the elongate patellae of the anterior legs and the same curious palpus. This type of palpus has been found in species of *Ischnothyreus*, *Scaphiella*, *Oonopinus* and *Dysderina*. Simon only mentions one protruding point at the tip of the bulb in *Stenoonops scabiculus* from St. Vincent and *S. nitens* has two.

Genus Oonopinus Simon 1892

Oonopinus pretiosus spec. nov.

Figures 2, 9

Male. Length, 1.2 mm.

Cephalothorax dull yellow, two-thirds as wide as long, smooth, rather low, anterior margin less than half the greatest width; *eye area* black, eyes cover less than half the width of head, a.l.e. largest of the six, round, separated by a radius, posterior row straight or very slightly recurved, p.m.e. a broad oval, touching, p.l.e. round, about equal to short diameter of p.m.e. and separated from them by a line; *clypeus* convex, with a few long hairs on margin, higher than diameter of a.l.e.; *mandibles*, long, cone-shaped, weak, fang long; *labium* about as wide as long, fused to sternum; *maxillae* with distal half narrowed, parallel, twice as long as labium; *sternum* convex, more than half as wide as long, tip pointed, lateral margins lobed with a distinct hairy point between II and III coxae, anterior coxae elongate, posterior sub-globose; *abdomen* white, cylindrical, fully twice as long as wide, with a few dark hairs at tip, hairs more numerous on venter, just anterior to spinnerets a pair of dark sacs beneath the skin; pedicel very short; *legs* not differing greatly in length; *palpus* short, white, cymbium and bulb fused, so that palpus looks not fully developed, patella and tibia subequal, with many dark hairs, cymbium at base two-thirds as thick as long, tip pointed with embolus at tip, a white curved tube.

Female. Length, 1.5 mm.

Female the same as the male with abdomen longer, flesh-colored and the dark sacs on venter more distinct than in the male.

Holotype ♂ St. Croix, (Beatty)

Allotype ♀ St. Croix, (Beatty)

The genus is based on a European species, but in the same paper, Simon described a male and a female in the same genus from Vene-

zuela. This species is twice as large as *Oonopinus pretiosus*, and the figure of the palpus shows the femur enlarged, patella greatly swollen and the bulb long and slender, extending at right angles from the cymbium. No mention is made of the sternum.

Genus Telchius Simon 1892

Telchius placidus spec. nov.

Figures 3, 4

Male. Length, 1.4 mm.

Cephalothorax pale yellow, sides with short dark hairs that are thickest about posterior margin, four-fifths as wide as long, rather low, sloping gradually from the anterior margin to within one-quarter of posterior margin where it falls rapidly, anterior margin narrowed, no thoracic groove; *eye area* not covering entire width of head, a.l.e. sub-rotund, convex, separated by about a radius, posterior row of eyes recurved, p.m.e. a broad oval, touching, p.l.e. round, about equal to short diameter of p.m.e., narrowly separated from p.m.e. and a little smaller than a.l.e.; *clypeus* convex, about as high as diameter of a.l.e., many long hairs on margin; *mandibles* vertical, cone-shaped; *labium* fused to sternum, wider than long; *maxillae* about twice as long as labium, almost parallel; *sternum* heart-shaped, convex, with a few long hairs about margins, margin not lobed, IV coxae separated by less than a diameter, anterior coxae elongate, posterior sub-globose; *abdomen* oval, flesh-colored with four pairs of faint darker spots, venter with scanty hairs and a pair of dark marks anterior to the spinnerets; *legs*, posterior pairs longest, anterior patellae long, tibia and metatarsus sub-equal, no spines but many hairs, posterior pairs with slender, unpaired spines on tibia and metatarsus; *palpus*, femur slender, patella and tibia sub-equal, each a little longer than their diameter, tarsus covering about half of the bulb, bulb much swollen at base, extending to a point, embolus at tip, a slender dark spine.

Female. Length, 1.5 mm.

Cephalothorax, eyes and *abdomen* same as in male, spinnerets longer; *legs*, anterior pairs with slender spines beneath tibia and metatarsus, tibia, ventral, 2–2, metatarsus, ventral, 2–2, posterior pairs with irregular spines; *epigynum* a straight, transverse slit with margins chitinized.

Holotype ♂ St. Croix, (Beatty)

Allotype ♀ St. Croix, (Beatty)

The genus is based on a female from Algeria described in a footnote in Simon's first paper on Spiders from Venezuela, (Ann. Soc. Ent. France, 1892, **61**, p. 446.) In the text, a second species, also a female is described. The genus differs from *Oonops* by the almost parallel maxillae, slender spines on the anterior legs and the elongate patellae of the anterior pairs. The male of this species has no spines on the anterior tibiae but the female has two pairs. The pair apparently belong together, as the eyes are the same, both have short hairs on the cephalothorax and the abdomen.

Genus Dysderina Simon 1891

Dysderina antillana spec. nov.

Figures 1, 7

Male. Length, 1.5 mm., ceph. 0.7 mm., abd. 0.7 mm.

Cephalothorax olive-brown, darker about lateral margins, nine-tenths as wide as long, head narrowed, carapace very high, rising from eye area to one-fifth from posterior margin where it falls abruptly; *eyes* cover fully one-half the width of the head, a.l.e. largest of the six, round, narrowly separated, posterior row straight, only slightly longer than anterior row, p.m.e. a broad ellipse, touching for some distance, p.l.e. round, smaller than a.l.e. and touching p.m.e.; *clypeus* equals about a radius of a.l.e., slightly convex; *mandibles* vertical, cone-shaped, pale, with a small dark hook that projects forward at base of the fang, fang groove short; *labium* pale, fused to sternum, one-half as long as wide, sides parallel; *maxillae* slightly inclined, distal half very narrow and parallel; *sternum* as wide as long, widest between II and III coxae, squarely truncate between IV coxae, convex, smooth, no hairs, IV coxae separated by a diameter and a half; *abdomen* almost two-thirds as wide as long, cylindrical, an olive-brown scutum covers two-thirds of dorsum, sides iridescent white with a few hairs, ventral scutum only slightly chitinized, extends from pedicel to within one-third of the spinnerets for almost the entire width of the abdomen, tip truncate, each side of the spinnerets a pair of dark sacs beneath the skin, spinnerets long; *legs*, III right and IV left missing, all coxae sub-globose, legs slender, pale, anterior patellae not elongate, spines, I pair, femur, 1–1 prolateral near tip, tibia, ventral, 2–2–2–2, long and overlapping, metatarsus, ventral, 2–2, long and overlapping, posterior pairs spineless; *palpus*, small, slender and dark.

Holotype ♂ St. Croix, (Beatty)

Simon based the genus *Dysderina* on three species found at St. Vincent, two that were new and a third that was originally found by Keyserling in Colombia and described in the genus *Oonops*. A year later, Simon described another species from Venezuela. Today, the genus is recognized as widely distributed, and has been divided in two sections, the first, with the posterior row of eyes straight, eyes large and contiguous and the a.l.e. separated by less than their diameter; the second section, with the posterior row of eyes procurved, p.l.e. a little separated from p.m.e. and a.l.e. separated by more than their diameter. *Dysderina antillana* belongs to the first section. It differs from its relatives in the small size and the palpus. As far as known, no species has been found with a hook on the mandibles above the base of the fang but this could be easily overlooked in so small a spider. However, it is very distinct under high magnification because of the dark color.

Genus Gamasomorpha Karsch 1881

Gamasomorpha perplexa spec. nov.

Figures 11, 12, 18

Male. Length, 1.5 mm., ceph. 0.8 mm., abd. 0.7 mm.

Cephalothorax bright brown, two-thirds as wide as long, (3 : 4.5), sparsely punctate, anterior margin narrowed, posterior margin slightly concave, no thoracic groove, carapace slopes gradually from anterior margin to within one-tenth of posterior margin, where it falls rapidly in a concave slope; *eyes* not covering entire anterior margin, a.l.e. largest of the six, separated by a little more than a radius, posterior row almost straight or slightly recurved, p.m.e. a broad ellipse, touching, p.l.e. round, less than a short diameter of p.m.e. and touching p.m.e.; *clypeus* narrow, less than a radius of a.l.e.; *mandibles* vertical, small and cone-shaped; *labium* almost triangular, fused to sternum; *maxillae* about twice as long as labium, inclined, narrow and lateral margins almost parallel; *sternum* triangular, more than two-thirds as wide as long, (2 : 2.5), convex and smooth, lateral margins distinctly lobed and area between elevated, tip truncate, IV coxae separated by more than a diameter; pedicel short; *abdomen* oval, brown, scutum covers entire dorsum, flat, punctate, probably in life a small hair from each pit as a few remain above spinnerets, venter almost completely covered by a scutum which meets the dorsal scutum at base and shows no opening for lung slits, a small infra-mammillary scutum on ventral side of spinnerets; *legs* short, pale brown, no spines, anterior coxae

elongate, posterior coxae globose, femora only slightly enlarged and laterally compressed; *palpus*, very dark brown, small and rather short, femur not enlarged, tibia globose, patella a little longer than tibia, tarsus with a dorsal row of seven clavate hairs, tarsus longer than tibia plus patella, palpal organ extends beyond cymbium almost the length of the tarsus, embolus at tip.

Female. Length, 1.5 mm.

Female the same size as the male with the same scuta and eyes as in the male; ventral scutum apparently divided at fold and the opening of the epigynum a small round depression in a pale area just posterior.

Holotype ♂ St. Croix, (Beatty)

Allotype ♀ St. Croix, (Beatty)

Paratypes 2 ♀ St. Croix, (Beatty)

According to the definition of the genus in the Histoire Naturelle des Araignées, 1893, **1**, p. 301, there is great variation in the size of the eyes of the posterior row, height of the clypeus, but the coxae are all globose. This species differs in having the anterior coxae elongate and a greater discrepancy in the size of the eyes of the posterior row than usual, but the legs are short and there is an infra-mammillary scutum.

Genus Hytanis Simon 1892

Hytanis pusilla spec. nov.

Figures 13, 14

Female. Length, 1.5 mm., ceph. 0.5 mm., abd. 1.6 mm.

Cephalothorax golden-brown, with a few long hairs, irregularly placed, almost as wide as long, (4.2 : 4.5), convex, but not very high, slopes gradually from anterior margin to opposite III pair of legs when it falls rapidly to posterior margin, anterior margin about half the greatest width, no thoracic groove; *eyes*, a.l.e. largest of the six, separated by two-thirds of a diameter, posterior row slightly recurved, longer than anterior row, p.m.e. a broad ellipse, touching, p.l.e. separated from p.m.e. by a little more than a line, smaller than a.l.e.; *clypeus* equals about a diameter of a.l.e., convex; *mandibles* long, cone-shaped, fang groove short; *labium* wider than long, fused to sternum; *maxillae* short, about one and a half times as long as labium, slightly inclined; *sternum* as wide as long, anteriorly truncate, lateral margins almost parallel, not emarginate between coxae, strongly convex, with a few long hairs, IV coxae separated by more than a diameter; *abdomen* more than twice as long as wide, convex, dorsum covered by a reddish-

brown scutum, sparsely punctate with a long colorless hair from each depression, a faint pattern can be traced on the scutum with a median pale stripe and darker spots each side, ventral scutum from pedicel to fold, followed by a paler scutum which passes the middle of venter, no scutum about spinnerets; *legs*, IV leg longest, all coxae sub-globose, femora only slightly compressed, patellae not greatly elongate, all legs with many long colorless hairs or bristles, no spines.

Holotype ♀ St. Croix, (Beatty)

The genus *Hytanis* was based by Simon on a female from Puerto Cabello, Venezuela. Both the generic and specific descriptions are very brief. It is compared with *Gamasomorpha*, but no mention is made of the ventral scutum. The elongate abdomen is not common in the *Oonopidae*. It cannot be placed in the genus *Gamasomorpha* because the ventral scutum is short and the infra-mammillary scutum is lacking; also the legs are long and slender.

Genus Scaphioides genus nov.

Cephalothorax moderately high; eye area covering about half the anterior margin, a.l.e. largest of the six, posterior row straight, p.m.e. an elongate ellipse and touching for some distance, separated from p.l.e. by little more than a line; all coxae sub-globose; sternum convex and lateral margins carried between coxae; abdomen, (female), with no dorsal scutum, epigastric scutum about square, from pedicel to epigastric fold, followed by a very narrow scutum which is little more than a line; legs spineless, anterior patellae elongate and dorsally flattened; male unknown.

Genotype *Scaphioides reducta* spec. nov.

This genus differs from *Scaphiella* Simon in the abbreviated ventral scutum in the female and the greatly elongate p.m.e.; it agrees with that genus in the straight posterior eye row and the elongate anterior patellae.

Scaphioides reducta spec. nov.

Figures 6, 8

Female. Length, 1.6 mm., ceph. 0.5 mm., abd. 1.0 mm.

Cephalothorax golden-brown, sides granular, almost three-quarters as wide as long, anterior margin much narrowed, posterior margin convex, moderately high, slopes gradually from anterior margin to within one-fifth of posterior margin when it falls rapidly in a convex slope; *eye area* covering about half the width of the head, a.l.e. largest

of the six, separated by a line, posterior row straight, longer than anterior row, p.m.e. a narrow ellipse, touching for some distance, p.l.e. round, little less than long diameter of p.m.e. and separated from p.m.e. by a line; *clypeus* convex, a little higher than diameter of a.l.e.; *mandibles* small, vertical; *labium* as long as wide, tip much narrowed; *maxillae* inclined over labium, but tips not touching, distal half much narrowed; *sternum* strongly convex, granular, lateral margins carried between coxae, IV coxae separated by more than a diameter, all coxae sub-globose; *abdomen* flesh-color, oval, convex, sparsely covered with short hairs, venter paler, with short hairs, a square scutum from pedicel to fold, followed by a scutum that is little more than a line, spinnerets short, each side, beneath the skin an irregular dark sac; *legs* moderately long, anterior patellae elongate and dorsally flattened, I patella three-quarters as long as I tibia, no spines but rows of short, colorless hairs; *epigynum* a long, transverse slit between epigastric scutum and the very narrow ventral scutum.

Holotype ♀ St. Croix, (Beatty)

Paratype ♀ St. Croix, (Beatty)

Family CAPONIIDAE

Genus Caponina Simon 1891

Caponina blanda spec. nov.

Figure 17

Male. Length, 4.6 mm., ceph. 2.1 mm., abd. 2.5 mm.

Cephalothorax bright orange, smooth, no hairs, oval, convex, more than two-thirds as wide as long, (4.5 : 6.0), anterior margin rounded and narrow, no thoracic groove; eyes on a black spot, two, round, separated by about a radius; *clypeus* at least three times the diameter of an eye, convex and sloping; *mandibles* vertical, shining, cone-shaped, fang groove short; *labium* longer than wide, fused to sternum; *maxillae* only little longer than labium, curved, so that tips almost meet, palpi inserted above the middle, distal half very little narrowed; *sternum* deep orange, shining, oval, about half as wide as long, lateral margins indentate, flat, IV coxae separated by more than a diameter; *abdomen* oval, dull green, scantily covered with short colorless hairs, venter little paler than dorsum; *legs* little paler than cephalothorax, 4–1–2–3, little difference in length, no spines and few hairs, I coxa longer than IV coxa, III coxa much smaller than others; *palpus* as long as cephalo-

thorax, pale yellow, femur long and slender, with no rasping spur, tibia longer than patella, cymbium as long as patella plus tibia, bulb globose and protruding from the cavity, embolus a pale, stout tube which leaves the bulb at base and becomes free before the middle.

Holotype ♂ St. Croix, (Beatty)

The genus *Caponina* was based by Simon on a female from St. Vincent. *Caponina blanda* differs in several points from the generic description, but these differences may be sexual. *Caponina testacea*, the genotype, is described as having the clypeus scarcely twice as high as the diameter of an eye and subvertical, the sternum is convex. In *Caponina blanda*, the clypeus is fully three times the diameter of an eye, and it is convex and sloping, the sternum is flat. The genus includes very few species, and the sexes are rarely found together.

Family OECOBIIDAE

Genus Oecobius Lucas 1845

Oecobius benneri Petrunkevitch

Oecobius benneri Petrunkevitch, 1929, p. 75, figs. 64–66. "♀ Puerto Rio; Rio Piedras"

Oecobius parietalis Petrunkevitch, 1926, *nec* Hentz, 1850.

♀ St. Croix, (Beatty)

Family LYCOSIDAE

Genus Lycosa Latreille 1804

Key to Females

1. Cephalothorax with a narrow median pale stripe extending to anterior eye row ..... *atlantica*
   Cephalothorax with median pale stripe as wide as space between p. l. e. 2
2. Sternum with a dark stripe 3
   Sternum pale 4
3. Venter almost covered with a dark spot ..... *sancti-vincenti*
   Venter pale ..... *sancti thomasi*
4. Anterior tibiae with small weak spines, spider about 20.0 mm. long ..... *reducta* spec. nov.
   Anterior tibiae with normal spines, spider about 12.0–13.0 mm. long ..... *subtilis* spec. nov.

Three species of *Lycosa* with a dark stripe on the sternum have been described from the West Indies. Two of these have a dark spot on the venter and all have an angulate tip to the basal spear-mark on the abdomen.

Lycosa sancti-vincenti Simon was described from both male and female, but no figures are given of the palpus and the epigynum. This species has three pairs of ventral spines on the first tibia and two prolateral spines. It is possible that *Lycosa yaucensis* Petr. from Puerto Rico is a synonym. This is described with one prolateral spine on the first tibia.

Lycosa sancti thomasi Petr., 1926, known only from the type, is about the same size, but all the dark marks are very faint, and the dark basal spear-mark on the abdomen fades about the middle, so that the tip cannot be seen. The prolateral spines on the first tibia are confusing as one leg has one spine and the other has two.

From the descriptions of all three species, the epigynum has the median septum slightly angulate about the middle.

Lycosa atlantica Marx

Lycosa atlantica Marx, 1889, p. 100, pl. 4, fig. 4. "♀ Bermuda"
5 ♀ St. Croix, (Beatty)

Lycosa reducta spec. nov.

Figure 25

Female. Length, 19.0 mm., ceph. 9.5 mm., abd. 8.5 mm., I tib. 5.0 mm.

Cephalothorax mahogany-brown, median pale stripe from p.l.e., margins gradually converging to posterior margin, in anterior half a pair of narrow dark stripes that do not reach the thoracic groove, a very narrow median stripe of white hairs from p.l.e. to anterior eye row, lateral pale stripes not as wide as dark stripe, with irregular margins, sides below eyes covered with fine white hairs; *eyes*, anterior row not as wide as second row, eyes equidistant, a.m.e. larger than a.l.e., eyes of second row separated by less than a diameter; *mandibles* dark brown, geniculate, three teeth on each margin; *abdomen* with a median spear mark that does not reach middle, tip forked, surrounded by a pale stripe, posterior half mottled and cross bars vaguely indicated, sides grayish-brown, entire dorsum with many long bristles, venter pale; *legs* with the two terminal joints darker, posterior femora with broken

dark rings on dorsal side, spines, no spines on anterior patellae, posterior patellae with 1 prolateral and 1 retrolateral, I pair, tibia, dorsal, 0, prolateral, 2, retrolateral, 0, ventral, 2–2–2, all spines very slender and weak, less than one-half the diameter of the joint, area between ventral spines thickly covered with short, white hairs, metatarsus, dorsal, 0, lateral, 0, ventral, 2–2, in a thick scopula, so that spines are hidden, basal and median, both pairs very small, II pair, spines the same as on I pair, but longer and scopula not as heavy, III and IV tibiae with a dorsal, basal spine, all spines on posterior pairs are long and heavy; *epigynum* very similar to *Lycosa subtilis* spec. nov. (cf. *postea*).

Holotype ♀ St. Croix, (Beatty)

This species is very near *Lycosa subtilis* but is much larger. The legs in proportion are shorter and stouter, the spines on the anterior tibiae and metatarsi are small and weak, and the anterior metatarsi have a thick scopula. *Lycosa aussereri* (Keys.) from Colombia is about this size, but the spines of the anterior tibiae and metatarsi are described as small and weak. Banks identified three specimens from Culebra and Vieques Islands as this species. Petrunkevitch mentions them in "The Spiders of Porto Rico", 1929, p. 91 and regarded them as probably *Lycosa fusca* (Keys.), 1876, described from Cuba. They are probably not *Lycosa aussereri* from Colombia, but it is equally questionable if they are *fusca*. The two islands lie between Puerto Rico and St. Croix, and they may prove to be *reducta*.

Lycosa sancti thomasi Petrunkevitch

Lycosa sancti thomasi Petrunkevitch, 1926, p. 67, fig. 22. "♀ St. Thomas"

Through the kindness of Dr. Shoemaker, I have been able to examine the unique type specimen.

The dark markings on the cephalothorax and abdomen are rather obscure; the median pale stripe on the cephalothorax is very little constricted anterior to the groove and the narrow pale lateral stripes are only faintly indicated; the abdomen has a dark basal mark that disappears about the middle, the dark median spot on the sternum is very faint and the entire venter is pale. The specimen has not oviposited.

The spines on the legs are confusing. The anterior patellae have no spines, the first tibia has three pairs of ventral spines, and the left leg one small prolateral spine beyond the middle ventral pair, the right leg has two prolateral spines, one beyond the middle pair and one much nearer the base. It is possible that one leg has been replaced but as

there is no difference in length or size, it is impossible to say which leg has been renewed.

Lycosa sancti-vincenti Simon

Lycosa sancti-vincenti Simon, 1897, p. 888. "♂ ♀ St. Vincent"

It is not impossible that Dr. Petrunkevitch had a small, pale specimen of this species from Puerto Rico, when he described *Lycosa yaucensis*. The Simon type is 12.0 mm. long, the venter is black and the sternum is black with a yellow margin; spines, I pair, patella, prolateral 1, tibia, ventral, 2–2–2, prolateral, 2 small spines, metatarsus, ventral, 2–2, apical whorl of 3 spines; epigynum is much longer than wide, subparallel and the margins reddish. Four specimens from St. Croix, collected by Dr. Wilson in 1922, and one from Antigua, collected in 1918, answer this description. A single specimen from St. Croix, collected by Beatty is smaller, (9.5mm.) and agrees very well with the description of *Lycosa yaucensis* Petr. The smaller specimen has irregular brown marks on femora and tibiae and the first tibia has but one prolateral spine. The figure of the epigynum has the median septum broad, slightly wider and angulate about the middle. All specimens seen have the same epigynum with the margin of the septum heavily chitinized.

4 ♀ St. Croix, (Wilson)
1 ♀ St. Croix, (Beatty)

Lycosa subtilis spec. nov.

Figures 16, 19

Female. Length, 12.5 mm., ceph. 6.6 mm., abd. 6.5 mm., I tib. 3.1 mm.

Cephalothorax with median pale stripe from p.l.e., narrowing before the thoracic groove, anterior half of pale stripe with narrow curved dark stripes ending opposite I coxae, lateral pale stripes rather broad, dark stripes covered with dark, short hairs; *eyes*, anterior row shorter than second row, eyes equidistant, a.m.e. separated by a radius, larger than a.l.e., eyes of second row separated by less than a diameter, scattered white hairs and longer bristles in eye area; *mandibles* mahogany-brown, geniculate, with many coarse dark bristles and shorter white hairs, fang groove oblique, thick scopula of long hairs at base of fang on superior margin, three teeth on each margin; *labium* longer than wide, lateral margins deeply notched at basal half, tip rebordered;

maxillae twice as long as labium; *abdomen* oval, dark basal mark extends to middle with tip truncate and each lateral corner extended in a a diagonal line that connects with lateral stripe, pale lateral stripes meet at base and fade before middle, distal half dark, with vague cross bars and four or five pairs of widely separated pale spots, venter pale with no marks; *legs* pale, distal joints darker and on posterior pairs very faint dark rings, most distinct on dorsal side, spines, no spines on anterior patellae, posterior pairs, 1 prolateral, 1 retrolateral, I pair, tibia, dorsal, 0, prolateral, 1, retrolateral, 0, ventral, 2 distal, 2–2, both pairs rather slender and the retrolateral row little more than bristles, area between with a thick covering of short hairs, but not as heavy as a scopula, metatarsus, dorsal, 0, lateral, 0, ventral, 2 basal, 2 median, 1 distal, II pair, spines same as on I pair but ventral hairs not as thick on tibia, III and IV tibiae with basal, dorsal spine; *epigynum* a median narrow septum, sides almost parallel and longer than cross piece.

Male. Length, 11.3 mm., ceph. 5.6 mm., abd. 5.5 mm.

Cephalothorax with median pale stripe which starts between p.m.e. and widens to width of p.l.e., gradually narrows to posterior margin, the pair of dark stripes in pale area not as long as in female, and followed on lateral margin by a pair of distinct dots, these can be traced in the female, marginal dark stripe narrower than in female, line of bristles below second and third eye row very distinct; *mandibles*, *labium* and sternum as in female; abdomen very distinctly marked, lateral pale stripes surround median dark spear mark and continue to spinnerets with posterior half crossed by broken chevrons, the pale spots reduced to two or three pairs, venter pale; *legs* pale, distal joints darker, interrupted dark rings can be traced on posterior pairs, spines, all patellae with 1 prolateral and 1 retrolateral spine, dorsal, basal spine on posterior tibiae, I pair, tibia, prolateral, 1, retrolateral, 2, ventral, 2–2–2, all spines large and heavy, metatarsus, dorsal, 0, prolateral, 2, retrolateral, 2, ventral, 2–2, 1 median apical spine; *palpus* as long as cephalothorax, slender, pale, tibia almost twice as long as patella and three-quarters as long as cymbium, tip of cymbium very narrow, the parts of the palpus very much like *Lycosa pratensis* Emerton, but larger.

Holotype ♂ St. Croix, (Beatty)

Allotype ♀ St. Croix, (Beatty)

Paratypes 5 ♀ St. Croix, (Beatty)

This species probably belongs in the same section of the genus as *Lycosa pratensis* Emerton, but it is much larger. The spines on the

legs are not the same in the male and female but the two undoubtedly belong together, as they have the same marks on the cephalothorax and abdomen. The female of *Lycosa pratensis* has the retrolateral row of ventral spines on the first tibia much reduced.

Genus Pardosa C. Koch 1848

Pardosa portoricensis Banks

Pardosa portoricensis Banks, 1901, p. 224, pl. 15, figs. 2, 3. "1 ♀ Porto Rico; San Juan"

2 ♀ St. Croix, (Beatty)

Family OXYOPIDAE

Genus Oxyopes Latreille 1804

Oxyopes salticus Hentz

Oxyopes salticus Hentz, 1845, p. 196, pl. 16, fig. 10; reprint, p. 47, pl. 6, fig. 10. "North Carolina, Alabama"

2 ♂ 2 ♀ St. Croix, (Beatty)

Family SICARIIDAE

Genus Scytodes Latreille 1804

Scytodes fusca Walckenaer

Scytodes fusca Walckenaer, 1837, 1, p. 272 "♂ ♀ Cayenne"; Petrunkevitch, 1926, p. 29.

5 ♀ St. Croix, U. S. Exper. Stat., (Wilson)

2 ♀ St. Croix, (Beatty)

Scytodes hebraica Simon

Scytodes hebraica Simon, 1891, p. 568, pl. 42, fig. 14. "♀ St. Vincent"

♀ St. Croix, 6 April 1922, (Wilson)

Scytodes lineatipes Tacz

Scytodes lineatipes Taczanowski, 1873, p. 107. "2 ♀ Cayenne et une des Iles du Salut"

immat. ♀ St. Croix, June 1922, (Wilson)

Scytodes longipes Lucas

Scytodes longipes Lucas, 1845, p. 71, pl. 1, fig. 2. "♂ Mexique"
♀ St. Croix, 24 April 1922, (Wilson)
immat. ♀ St. Croix, (Beatty)

Family PHOLCIDAE

Genus Artema Walckenaer 1837

Artema atlanta Walckenaer

Artema atlanta Walckenaer, 1837, **1**, p. 656, "♂ ♀ Amer. merid. . . . . du Brazil"; Petrunkevitch, 1926, p. 27.
♀ St. Croix, (Beatty)

Genus Modisimus Simon 1893

Modisimus montanus Petr.

Modisimus montanus Petrunkevitch, 1929, p. 131, figs. 120–126. "♂ ♀ Porto Rico"

Petrunkevitch described the female as 3.5 mm. long. Seven females and a male were found under rocks between Lares and Yauque and another female at Guainabo. Three females were found by Beatty that probably belong to this species, although they are about half the size, (1.5 mm.). They have the same arrangement of eyes, with a dark stripe from the eye turret to margin of the clypeus and the same epigynum.
3 ♀ St. Croix, (Beatty).

Genus Physocyclus Simon 1893

Physocyclus globosus (Tacz.)

Pholcus globosus Taczanowski, 1873, p. 105. "3 ♀ Cayenne"
♀ St. Croix, 27 March 1922, (Wilson)

Genus Smeringopus Simon 1890

Smeringopus elongatus (Vinson)

Pholcus elongatus Vinson, 1864, p. 135. "♀, île de la Réunion"
♂ ♀ St. Croix, March, June 1922, (Wilson)

Family DICTYNIDAE

Genus THALLUMETUS Simon 1892

THALLUMETUS PARVULUS spec. nov.

Figures 20, 22, 23

Male. Length, 1.0 mm.

Cephalothorax brown, posterior portion of head with a few gray stripes which meet at beginning of thoracic portion, head very high, a median line of curved bristles from anterior eye row to thoracic portion, radial striae shaded; *eyes*, anterior row straight, a.m.e. small, separated by a diameter, almost touching a.l.e., a.l.e. about twice the diameter of a.m.e., posterior row slightly procurved, almost straight, little longer than anterior row, p.m.e. separated by little less than a diameter, subequal with a.l.e. and separated from p.l.e. by about a radius, lateral eyes touching; *quadrangle* wider behind than in front and as high as wide; *clypeus* higher than diameter of a.l.e. with a few long bristles in middle directed downward; *mandibles* long, swollen at base, median margin excavate about middle; *labium* longer than wide; *sternum* pale, convex, widest between II coxae and pointed between IV coxae, IV coxae separated by a diameter; *abdomen* oval, dorsum flattened, covered with long hairs, a median basal dark stripe which does not reach the middle, with pale lateral stripes almost as wide as dark stripe, these meet and continue to near the spinnerets, lateral margins of pale stripe irregular, venter pale, *spinnerets*, basal pair separated by a scant diameter; *legs*, pale, varying little in length, covered with hairs, no spines; *palpus* pale, shorter than cephalothorax, femur greatly swollen, so that it is more than half as wide as long, with a dark ventral chitinized carina near tip, this evidently rubs on a flattened lobe on ventral side of tibia, patella swollen on dorsal side, tibia very short and almost covered by patella, with a bifid prolateral process much chitinized, cymbium prolonged in a point, bulb circular and a little convex, embolus a stout black spine from near the tip which follows the contour of the cavity to near base.

Female. Length, 1.3 mm.

Cephalothorax same as in the male but the median row of bristles does not extend beyond the posterior eye row; *eyes* and *clypeus* same as in male; *mandibles*, median margin not as much excavate; *sternum* and *legs* the same; *abdomen* larger than in male, covered with short hairs that in some lights are iridescent, lateral pale stripes meet posterior to the dark basal spear mark and end abruptly with a transverse

line about one third from the tip, venter pale, cribellum not divided, calamistrum a single row of 10–12 curved hairs, extends from near base to very near tip of IV metatarsus; *spinnerets* separated, basal pair longest and separated by about two diameters, median pair very small and touching, superior pair about two-thirds as long as basal and separated by more than a diameter; *epigynum* very faintly marked, apparently two oval openings that are separated by at least their long diameter.

Holotype ♂ St. Croix, (Beatty)

Allotype ♀ St. Croix, (Beatty)

Paratype ♂ 2 ♀ St. Croix, (Beatty)

The genus *Thallumetus* was described in the Histoire Naturelle des Araignées, **1**, p. 241 which was published in October, 1892. It is based on males found in three localities in Venezuela. The genotype species was described in the Ann. Soc. Ent. France, **61**, p. 434, pl. 9, fig. 7, which was issued in April 1893, six months after the description of the genus. *Thallumetus* is separated from *Dictyna* in both sexes, by the slightly procurved posterior eye row and in the female by the widely separated spinnerets, in the male these are not as widely separated. The male palpus has the femur much enlarged. The genotype is much larger than the St. Croix species and differs in a few minor points. *Thallumetus salax* has the eyes of the anterior row equal and the palpus is figured with the patella slender, while in *Thallumetus parvulus* the eyes of the anterior row are very unequal and the patella of the palpus is greatly swollen on the dorsal side.

Family THERIDIIDAE

Genus Lithyphantes Thorell 1870

Lithyphantes septemmaculatus Keys.

Lithyphantes septemmaculatus Keyserling, 1884, p. 141, pl. 6, fig. 88. "♀ Denver, Colorado; Enterprise, Fla."

♀s St. Croix, (Beatty)

Genus Conopistha Karsch 1881

Three species of the genus *Conopistha* have been found on St. Croix. The males are easily separated by the anterior horn and the palpus. I do not agree with Dr. Petrunkevitch in his description of the species found on Puerto Rico, that the structure of the male palpus is not a

safe character to use in the identification of species, (1930, p. 179). The genus is easily separated, in the males, into two sections by the shape of the cymbium, the first with the distal end of the palpus produced in a prolateral lobe, and the second with the distal end contracted in a rounded tip.

Taczanowski was the first author to recognize the genus in the New World and in "Les Aranéides de la Guyane française", 1872, he describes several species. Of these, probably *nephilae* has been reported most often. Unfortunately, this species was not figured until 1880, when O. P. Cambridge wrote his paper on the genus. It was evident that he never saw the types, and he confused two species. In 1884, Keyserling, who had the Taczanowski types, corrected the error made by Cambridge in "Die Spinnen Amerikas", but for some strange reason this correction has never been followed. Keyserling also suggested that *lugens* and *jucunda*, both described by Cambridge from the Amazons, are the females of *nephilae* Tacz. In the text, Cambridge suggests that *lugens* may be the female of *concinna* which is considered as a synonym of *nephilae* Tacz.

In 1891, Keyserling in "Die Spinnen Amerikas, Brasil," p. 215, renamed the species that Cambridge had misnamed *nephilae* as *cambridgei*. This is the species that is so widely distributed in northern South America, most of the islands of the West Indies and the southern part of the United States.

The females of the genus are not easy to place. The epigynum is often filled with a dark brown substance, so that the openings are impossible to see and the dark color on the venter may extend on the sides or even to the dorsum, so that the color pattern is of little value.

Conopistha cambridgei (Keys.)

Figures 21, 24

Argyrodes nephilae, O. P. Cambridge, 1880, p. 324, *nec* Taczanowski, 1872, "♂ ♀ Amazons"; Petrunkevitch, 1929, p. 179, figs. 19–22, *nec* Taczanowski, 1872.

Argyrodes cambridgei Keyserling, 1891, p. 215.

Male. Length, 2.0 mm., ceph. 1.0 mm., abd. 1.0 mm.

Cephalothorax yellowish-brown, flat, two-thirds as wide as long, thoracic groove transverse, anterior horn very slender, starts midway between margin of the clypeus and the eyes, with the ventral surface concave, best seen in a lateral view, tip a rounded knob projects out-

ward, covered with hairs and is as narrow as space between a.m.e.; *eyes* median eyes project forward on a lobe, p.m.e. separated by more than a diameter, lateral eyes touching, about twice as far from space between horn and eye lobe, as a.l.e. plus p.l.e.; *clypeus* vertical from margin to base of horn; *labium* fused to sternum; *sternum* dark brown, triangular, widest between I pair of coxae, IV coxae separated by almost a diameter, lateral margins carried between coxae; *abdomen* silvery, often with a median dark line from base to near tip, posterior part of abdomen high, so that height over spinnerets equals length, tip produced upwards, rather than backwards, tip dark, basal part of abdomen a narrow chitinized ring, with anterior margin roughened, can be seen from dorsal side, venter almost black, with a pair of silvery spots anterior to spinnerets, margin between black venter and silvery sides scalloped; *palpus* pale, as long as cephalothorax, patella swollen dorsally, cymbium with tip widened, with a large hairy prolateral lobe at end, this lobe rounded and not chitinized as in *Conopistha nephilae,* best seen in the figure.

Female. Length, 2.0 mm., ceph. 1.0 mm., abd. 1.0 mm. long, 1.3 mm. high.

Abdomen with the same markings as in the male but often higher.

♂s ♀s St. Croix, (Beatty)

Conopistha cancellatus (Hentz)

Theridion cancellatum Hentz, 1850, p. 278, pl. 19, figs. 17, 18; reprint, p. 149, pl. 16, figs. 17, 18.

♂ ♀ St. Croix, (Beatty)

Conopistha nephilae (Tacz.)

Figures 15, 26

Argyrodes nephilae Taczanowski, 1872, p. 114. "♂ ♀ Cayenne, des Iles du Salut et de Saint Laurent de Maroni;" Keyserling, 1884, p. 184, pl. 8, fig. 110.

Argyrodes concinna O. P. Cambridge, 1880, p. 322, pl. 38, fig. 2. "♀ Amazons"

Argyrodes lugens id., ibid., p. 327, pl. 38, figs. 2a', b', c'. "♀ Amazons"

Argyrodes jucunda id. ibid., p. 326, pl. 38, fig. 6. "♀ Amazons"

Conopistha elongata Bryant, 1940, p. 306, figs. 68, 69, 75, 76.

Male. Length, 2.5 mm., ceph. 1.2 mm., abd. 1.3 mm.

Cephalothorax yellowish-brown, flat, quite long and about half as wide as long, thoracic groove transverse and deeply impressed, one-

third nearer posterior margin than anterior, horn starts at margin of clypeus, very wide, narrowed gradually, tip not swollen, turned towards eyes, spoon-shaped, so that eye lobe apparently fits in it, about as wide as eye lobe and covered with short hairs, very little space between eye lobe and horn, ventral surface of horn convex; *eyes*, median eyes carried forward on a lobe, a.m.e. separated by a diameter, lateral eyes touching and at least three diameters of a.l.e. plus p.l.e. from space between horn and eye lobe; *labium* fused to sternum, wider than long; *maxillae* more than twice as long as labium, sides parallel; *sternum* yellowish-brown, triangular, widest between I pair of coxae, carried between II and III coxae and pointed in front of IV coxae, IV coxae touching; *abdomen* silvery, posterior tubercle rounded and directed backward, so that it extends beyond the plane of the spinnerets, a basal chitinized ring, easily seen in dorsal view, for stridulatory organ, carried on to ventral plate, venter infuscate with chitinized spots and lacking the usual silvery spots; *palpus* pale, terminal joint brown, as long as cephalothorax, patella swollen dorsally, twice as long as tibia, cymbium with tip widened and corners produced as lobes, prolateral lobe with tip strongly chitinized, bifid, with margins rolled inward.

Female. Length, 3.1 mm., ceph. 1.1 mm., abd. 2.1 mm. long, 3.4 mm. high.

Abdomen very high, not extending beyond the spinnerets as in the male, but rather upward, tip of abdomen contracted, venter very dark, with the usual pair of silver spots very faint, dark area extends on sides. O. P. Cambridge was undecided if *lugens* was the female of *concinna*, but he notes that both were from the same locality. The same is true of *jucunda*.

Genus Theridion Walckenaer 1805

The genus *Theridion* is based on a European species, and today it harbors a great many species that eventually will be placed in other genera. This particularly, is true of the species found in the West Indies. But until the fauna of more of the islands is known, it is thought best to leave these species in the genus as defined by Simon in the Histoire Naturelle des Araignées.

THERIDION BREVIPALPUS spec. nov.

Figures 28, 31, 32

Male. Length, 1.2 mm.

Cephalothorax yellow, shading to brown about the eyes, moderately high, smooth and shining, anterior margin not much narrowed, two very long bristles posterior to lateral eyes and a median row of three very long bristles, no thoracic groove; *eyes* cover the entire width of the head, anterior row slightly recurved, a.m.e. diurnal, slightly larger than a.l.e., separated by more than a radius and slightly nearer the a.l.e., lateral eyes touching, posterior row slightly procurved, each eye surrounded by a copper-red ring, p.m.e. largest of the eight, separated by a radius and from p.l.e. by a little more; *quadrangle* of median eyes higher than wide and narrower in front; *clypeus* about as high as quadrangle and convex; *mandibles* vertical, cone-shaped, fang long, fang groove poorly defined; *labium* brown, fused to sternum, wider than long, tip only slightly narrower than base and not rebordered; *maxillae* twice as long as labium, strongly inclined over labium; *sternum* pale, heart-shaped, strongly convex, IV coxae separated by more than a diameter; *abdomen* triangular, as wide as long, widest at basal third, tip pointed, dorsum flat, brown with no distinct pattern but blotches of cream-white and a darker brown about margins and three pairs of transverse dark bars on distal third, venter a pale brown, spinnerets inconspicuous; *legs*, IV left missing, anterior pairs very long, slender, all legs pale, femora with a wide dark band about middle that fades at distal and basal ends, distal joints almost white, with a broken ventral dark stripe on anterior tibiae, anterior femora slightly incrassate with two parallel ventral rows of small cusps, similar to *Crustulina* and at distal end, two widely separated rows of long slender bristles or spines, these bristles are from a distinct base and when broken, the scar can be seen, a long dorsal bristle at tip of patellae, a long dorsal bristle at middle of tibiae, no long bristles or spines on posterior pairs but rows of colorless hairs, tarsi about half as long as metatarsi, IV tarsus with a comb of 7 or 8 bristles; *palpus* very short, but little longer than the mandibles, femur, patella and tibia white, terminal joint brown, patella and tibia subequal, palpal organ fills the cavity, has no structure that can be seen, but has two slender dark spines at tip.

Holotype ♂ St. Croix, (Beatty)

The generic position of *Theridion brevipalpus* is uncertain. It belongs to the genus *Theridion* in the sense used by Simon in "Histoire Naturelle des Araignées", but it is undoubtedly a new genus as the legs have distinct spines and the palpus is very simple.

THERIDION CYBELE spec. nov.

Figure 39

Female. Length, 1.5 mm., ceph. 0.6 mm., abd. 0.9 mm. lon , 1.0 mm. wide.

Cephalothorax pale, with a median gray stripe which starts posterior to the p.m.e. and does not reach the posterior margin, wider than long, no thoracic groove, rather high, posterior fifth falls rapidly to margin; *eyes* cover width of the head, anterior row recurved, a.m.e. diurnal, separated by more than a diameter, a.l.e. smaller and separated from a.m.e. by only a line, posterior row slightly procurved, same length as anterior, each eye surrounded by a red ring, equidistant, p.m.e. separated by fully a diameter and a little larger than p.l.e.; *quadrangle* of median eyes, wider in front and higher than wide; *clypeus* convex, as high as quadrangle, margin dark; *mandibles;* vertical, rather small, pale with a dark stripe on middle margin, no boss, fang weak, impossible to see margin of fang groove; *labium* narrow, much wider than long, fused to sternum; *maxillae* more than twice as long as labium, very slightly inclined; *sternum* pale, convex, two-thirds as wide as long, truncate between IV coxae; *abdomen* wider than long, triangular, dorsum flat, a pair of divergent basal dark spots which soon fade into the white of the dorsum, many small dark dots, from each of which comes a long slender hair, near tip, a pair of converging dark stripes, venter infuscate, with curving dark stripes at base; *legs*, 1–4–2–3, short, pale with dark ventral spots on all joints, distal spots heaviest, a slender dark spine at tip of patellae and middle of tibiae, IV tarsus with a comb of 6 or 7 curved bristles; *epigynum* rather large for so small a spider and protruding from the plane of the venter.

Holotype ♀ St. Croix, (Beatty)

Paratype ♀ St. Croix, (Beatty)

This species does not belong to the genus *Theridion* in the strict sense, as the legs have spines and the epigynum is much more complicated than is usually found in that genus. Because of the spotted legs and the very broad abdomen with the small dark dots, it is a striking species.

Theridion guanicae Petr.

Figure 36

Theridion guanicae Petrunkevitch, 1930, p. 208, figs. 57, 58. "♀ Porto Rico"

This species was described from two females collected from under a rock in a cactus field near the coast at Guanica, Puerto Rico, January 7, 1926 by Dr. Petrunkevitch. A male and a female were found by Beatty at St. Croix. These specimens agree very well with the description except in a few minor points. The eyes are carried forward, best seen in a lateral view, and below the anterior row of eyes there is a groove shown in figure no. 57 as a straight line. The clypeus is convex; sternum convex, with the lateral margins slightly carried between the coxae, posteriorly the sternum is very wide, squarely truncate and carried between the coxae almost to the pedicel. The St. Croix female has the abdomen rather shrunken, so no markings can be traced.

Male. Length, 1.0 mm.

Cephalothorax same as in female, except for a pair of very long bristles below the a.m.e. directed anteriorly and four shorter bristles in a procurved row at the beginning of the thoracic slope; *mandibles*, tooth on the median margin of the fang groove larger than in female; *sternum* pale brown, truncate posteriorly, IV coxae separated by almost two diameters, lateral margins not carried between coxae; *abdomen* whitish, with a faint median gray stripe, scantily covered with long hairs, globose, venter pale; *legs* little paler than cephalothorax, rather short, little difference in length, I pair, tibia and metatarus with a prolateral and retrolateral rows of long, colorless bristles; *palpus* short, in a ventral view near the tip on the prolateral side is a broad curved truncate piece that supports the embolus.

Allotype ♂ St. Croix, (Beatty)

♀ St. Croix, (Beatty)

The palpus indicates that this species belongs in the same section of the genus as *Theridion unimaculatum* Emerton.

Theridion minutum (Petr.)

Spintharus minutum Petrunkevitch, 1926, p. 51, fig. 11. "♀ St. Thomas"
Theridion dexteri Petr., 1930, p. 200, figs. 45–50. "♂ ♀ Porto Rico, Campus of University at Rio Piedras"

Male. Length, 1.7 mm.

Female. Length, 2.2 mm.

In both male and female, the head is much higher than is usual in the genus, thoracic groove near the posterior margin, usually marked

by a black dash or line; a.m.e. diurnal, other eyes colorless; abdomen globose, base high, a dirty white, often marked with five small black dots, four in a quadrangle, followed by a fifth in the median line; legs, anterior pairs very long, a black dot each side on patellae and tibiae, with many long colorless hairs and bristles and on the first tibia of both male and female at distal end, a prolateral row of four long spines and a ventral p. row of long bristles, all longer in the male than in the female; *epigynum* in all specimens very lightly chitinized, one specimen, (no. 22, Wilson coll.), shows distinctly the two pairs of circles shown by Petrunkevitch, 1926, fig. 11, but the posterior pair is small and apparently the openings, anterior pair larger and beneath the skin; *palpus* large for the size of the spider, agrees with the Petrunkevitch, 1930, figs. 48, 49, except that no tibial spur can be seen; this spur is figured as large and almost at right angles to tibia, however, the palpal organ agrees with the figure in all parts.

♂ ♀ St. Croix, 28 March 1922, (Wilson)

♂ ♀ St. Croix, (Beatty)

This species is not a *Spintharus*, since the posterior row of eyes is straight, and the genus is based on the strongly procurved posterior eye row. Neither is it a true *Theridion* as the palpus is totally unlike any in the genus and there are true spines on the legs of both male and female.

In the collection sent by Dr. Wilson, there is a male and several females and one cocoon of eggs. The mesh of the cocoon is very loose, so that the eggs can be seen plainly. A note on the original label states that the specimens are always green, even the eggs, "always found as a single individual on a leaf. The web is very small, thin and scarcely visible. The spiders are easily captured. Species rather common."

The species was described from a single female taken by Dr. Shoemaker, July 1915 on St. Thomas. Through the kindness of Dr. Shoemaker, I have been able to examine the type. The specimens collected by Wilson and Beatty on St. Croix, agree with it perfectly, and also with the description of *Theridion dexteri* Petr. 1930 from Puerto Rico.

Theridion virginus spec. nov.

Figure 27

Male. Length, 1.8 mm.

Cephalothorax pale brown, with a converging vague dark stripe from the lateral eyes to about the middle, lateral margins darker, four-fifths as wide as long, thoracic groove a slight transverse depression; *eyes*

cover width of head, each eye surrounded by a bright red ring, anterior row recurved, a.m.e. diurnal, separated by fully a diameter and from a.l.e. by a radius, lateral eyes touching, subequal, posterior row straight, eyes equidistant, p.m.e. separated by a scant diameter, p.l.e. smaller than p.m.e.; *quadrangle* of median eyes wider in front and as high as wide; *clypeus* as high as quadrangle, a slight depression below anterior eye row and then convex to margin; *mandibles* pale, long and attenuate, a slight swelling near base on lateral margin, fang groove short; *labium* fused to sternum, triangular; *maxillae* one and a half times as long as labium, narrow, strongly inclined; *sternum* triangular, as wide as long, pale, margins dark; *abdomen* oval, twice as long as wide, dorsum flat, olive-brown with a pair of narrowly separated, interrupted white stripes, each side much darker from dark blotches, venter infuscate, epigastric fold extends beyond the middle, spinnerets inconspicuous; *legs*, III left missing, 1–2–4–3, I pair very long, pale, with a narrow broken dark ring at tip of femur, a small dark spot on patella and at tip of tibia, no spines but rows of colorless hairs, other pairs pale with the same dark spots as on I pair; *palpus* rather short, pale, terminal joint darker, palpal organ filling cavity, with the same parts as in *Theridion frondeum* Hentz.

Holotype ♂ St. Croix, (Beatty)

Theridion virginus belongs near *Theridion frondeum* Hentz, which has been placed in the genus *Phyllonethis*. This genus has been synonymized with *Theridion*, but sometime it may be used as a sub-genus. *Theridion frondeum* was reported by Simon from St. Vincent, 1897. It is not impossible that his spider was the one here described, because *frondeum* is a northern species and has never been reported from any other island of the West Indies.

Family ARGIOPIDAE

Genus Argiope Audouin 1825

Argiope argentata (Fabr.)

Aranea argentata Fabricius, 1775 **2**, p. 414. "♀ India"; Petrunkevitch, 1926, p. 29.

♀ St. Croix, (Wilson, Beatty)

Argiope trifasciata (Forskal)

Aranea trifasciata Forskal, 1775, p. 40. "♀ Kahirae"

♂ ♀ St. Croix, (Beatty)

Genus Acacesia Simon 1895

Acacesia folifera (Marx)

Epeira folifera Marx, 1890, p. 545.
Epeira foliata Hentz, 1847, p. 475. "♀ Alabama"; preoccupied by Walckenaer, 1837, **2**, p. 62.
2 ♀ St. Croix, (Beatty)

Genus Cyclosa Menge 1866

Cyclosa oculata (Walck.)

Aranea oculata Walckenaer, 1802, p. 428. "♂ ♀ Paris"
Cyclosa walckenaeri Petrunkevich, 1926, p. 29.
♂ ♀ St. Croix, (Beatty)

Genus Eustala Simon 1895

Eustala anastera (Walck.)

Epeira anastera Walckenaer, 1837, **2**, p. 33. "Georgia, Abbot, Georgia spiders, fig. 381"
♂ ♀ St. Croix, (Beatty)

Genus Eriophora Simon 1894

Eriophora edax (Blackwall)

Epeira edax Blackwall, 1863, p. 30. "♂ ♀ Rio Janeiro"
♀ St. Croix, (Beatty)

Genus Metepeira F. O. P. Cambridge 1903

Metepeira labyrinthea (Hentz)

Epeira labyrinthea Hentz, 1847, p. 471, pl. 31, fig. 3. "♀ North Carolina, Alabama"
Araneus (Metepeira) labyrinthens Petrunkevitch, 1926, p. 27, "St. Croix, common on telephone wires"
♂ ♀ St. Croix, (Wilson, Beatty)

Genus Neoscona Simon 1864

Neoscona oaxacensis (Keys.)

Epeira oaxacensis Keyserling, 1863, p. 121. "♀ Oaxaca, Mexico"
♂ ♀ St. Croix, (Beatty)

Genus Nephila Leach 1815

Nephila clavipes (Linn.)

Aranea clavipes Linnaeus, 1767, p. 1034, no. 27. "♀ in America"
Nephila clavipes Petrunkevitch, 1926, p. 30.
♀ St. Croix, (Beatty)

Genus Alcimosphenus Simon 1895

Alcimosphenus licinus Simon

Alcimosphenus licinus Simon, 1895, p. 951. "♀ Jamaica et S. Domingo"
♀ St. Croix, (Beatty)

Genus Leucauge White 1841

Leucauge argyra (Walck.)

Tetragnatha argyra Walckenaer, 1837, **2**, p. 219. "♂ ♀ La Guadeloupe"
Leucauge argyra Petrunkevitch, 1926, p. 29. "common, St. Thomas"
♂ ♀ St. Croix, (Beatty)

Leucauge regnyi (Simon)

Argyroepeira regnyi Simon, 1897, p. 871. "♂ ♀ St. Vincent"
Leucauge regnyi Petrunkevitch, 1926, p. 30. "♀ St. Thomas"
immat. ♀ St. Croix, (Beatty)

Genus Tetragnatha Latreille 1804

Tetragnatha antillana Simon

Tetragnatha antillana Simon, 1897, p. 868. "♂ ♀ St. Vincent"
♂ ♀ St. Croix, (Beatty)

Tetragnatha piscatoria Simon

Tetragnatha piscatoria Simon, 1897, p. 869. "♂ St. Vincent"
♂ St. Croix, (Beatty)

Genus Wendilgarda Keyserling 1886

Wendilgarda theridionina Simon

Wendilgarda theridionina Simon, 1895, p. 919, fig. 986. "♂ ♀ Venezuela; San-Esteban"
♀s St. Croix, (Beatty)

Genus GASTERACANTHA Sundevall 1833

GASTERACANTHA TETRACANTHA (Linn.)

Aranea tetracantha Linnaeus, 1767, p. 1037, no. 45. "♀ St. Thomas"
Gasteracantha tetracantha Petrunkevitch, 1926, p. 29. "♂ ♀ St. Thomas"
♀s St. Croix, (Beatty)

Family GNAPHOSIDAE

Genus TEMINIUS Keyserling 1887

TEMINIUS INSULARIS Keys.

Teminius insularis Keyserling, 1887, p. 422, pl. 6, fig. 1. "♀ Hayti"
Syrisca hirsuta Petrunkevitch, 1926, p. 63, figs. 20, 21, ♂ Sta. Maria Bay, St. Thomas, July 28; *nec.* Petrunkevitch, 1925, p. 151, figs. 74–76.
Eutychuroides fusca Petrunkevitch, 1926, p. 57, fig. 17. "2 ♀ St. Thomas"

Through the kindness of Dr. Shoemaker, I have been able to examine one of the females of *Eutychuroides fusca* that was used by Dr. Petrunkevitch in his description. It is probably one moult from maturity and was killed soon after moulting, as the spinnerets are extended and apparently longer than in an adult specimen. The maxillae are very faintly impressed, but the specimen agrees in all other respects with the Keyserling type from Haiti.

Dr. Petrunkevitch gives a long, detailed description of the male found on St. Thomas and calls attention to the difference in the eyes and the proportion of the various parts of the palpus from the male described by him from Panama. He also calls attention to the long posterior pair of spinnerets, and the faint depression on the maxillae.

The male and female differ greatly in size and the size of the spines on the anterior pairs of legs. In the female, the three pairs of ventral spines on the first tibia are so slender that they are easily overlooked or recognized only as bristles, in the mass of hairs that cover the joint; this is particularly true of the apical pair. In the male, the covering of hairs is not as thick, and the spines are heavy and much longer than the diameter of the joint, so they are very conspicuous. The male and female have the same pale stripe on the cephalothorax and the basal half of the abdomen, with chevrons on the posterior half.

♀ St. Croix, 30 March 1922, (Wilson)
♂ ♀ St. Croix, (Beatty)

Family SPARASSIDAE

Genus Heteropoda Latreille 1904

Heteropoda venatoria (Linn.)

Aranea venatoria Linnaeus, 1767, p. 1035. "in America calidiore"
Heteropoda venatoria Petrunkevitch, 1926, p. 30.
♂ s ♀ s St. Croix, (Beatty)

Genus Olios Walckenaer 1837

Olios antiguensis (Keys.)

Sparassus antiguensis Keyserling, 1880, p. 264, pl. 7, fig. 146. "♂ ♀ Antigua"
♂ ♀ St. Croix, (Beatty)

Genus Pseudosparianthis Simon 1887

Pseudosparianthis antiguensis Bryant

Pseudosparianthis antiguensis Bryant, 1923, p. 13, pl. 1, fig. 4. "♀ Antigua"
2 ♀ St. Croix, (Beatty)

Family SELENOPIDAE

Genus Selenops Latreille 1819

Selenops lindborgi Petr.

Figures 29, 37

Selenops lindborgi Petrunkevitch, 1926, p. 55, fig. 16. "♀ Sta. Maria Bay, St. Thomas, July 28"

Male. Length, 6.5 mm., ceph. 3.3 mm. long, 3.6 mm. wide, abd. 3.0 mm. long, 2.6 mm. wide.

Cephalothorax pale yellow, darker about the margin, with a row of slender hairs or bristles on margin directed forward, wider than long, very flat, thoracic groove longitudinal and faint, radial striae distinct near groove but disappearing before margin; *eyes* in three groups, four central and two in each lateral group, all eyes heavily ringed in black, eyes of median group in a recurved row, central eyes separated by about three-quarters the diameter of the next eye, posterior lateral eye on a large rounded tubercle, largest of the eight and directed backward, inferior lateral eye very small, about one-half diameter of central eye and about midway between median eye and p.l.e.; *clypeus*

less than a radius of central eye, with a scant fringe of long hairs on margin; *mandibles* vertical, rather small, yellow with stripes of dull gray, boss small and inconspicuous, fang groove oblique, superior margin with three widely separated teeth, inferior margin with two teeth; *labium* yellow, longer than wide, tip rounded, slightly excavate on lateral margins at base; *maxillae* parallel, fully twice as long as labium; *sternum* pale, slightly wider than long, bifid between IV coxae; *abdomen* pale, with lateral and posterior margins gray, flat, anterior margin truncate, venter pale; *legs*, I, II and IV left and III right missing, yellow with no indications of the wide dark bands found in the female, spines much shorter than in female, spines, I pair, patella, 0, tibia, dorsal, 1, prolateral, 2, retrolateral, 2, ventral, 2–2–2–2, distal pair very small, metatarsus, dorsal, 0, prolateral, 1, retrolateral, 0, ventral, 2–2, II pair, tibia, dorsal, 2, prolateral, 2, retrolateral, 2, ventral, 2–2–2, metatarsus, prolateral, 2, retrolateral, 1, ventral, 2–2; *palpus* shorter than cephalothorax, pale, tibia little longer than patella, tibia with no dorsal apophysis, large lateral apophysis as figured.

Allotype ♂ St. Croix, (Beatty)

3 ♀ St. Croix, (Beatty)

It is not impossible that the first leg of the male has been renewed recently, as it is shorter than the second leg and the spines are much smaller.

It is with some hesitation that these specimens are identified as *Selenops lindborgi* Petrunkevitch. The type specimen is from St. Thomas and it is described as 12.3 mm. long, but it may not be adult. In some genera, the penultimate stage is longer than the adult. The three females from St. Croix are all smaller than the dimensions given for the type, as the largest is only 10.0 mm. long, but they agree with the description in the size and position of the eyes and in the spines. The epigynum of one of the specimens is figured. This differs somewhat from the figure of the type, but F. O. P. Cambridge in the Biol. Centr. America, 1900, **2**, p. 117, says, "The vulva in *Selenops* varies very much in detail, so that many specimens obviously the young of *S. mexicanus* appear at first sight to belong to entirely different species."

Selenops longipes Petrunkevitch from Puerto Rico, known only from the male, is very near *S. lindborgi*. Dr. Gertsch has kindly sent me drawings of the eyes and the palpus of the type specimen in the American Museum. The median eyes are round, not ellipical as figured and the median eyes touch the neighboring eye as stated in

the text. In the palpus, the long process at the base of the embolus is folded longitudinally and one corner of the tip is prolonged in a sharp point. The various parts of the palpus are very similar in the two species. The greatest difference is in the eyes. It is not impossible that the smaller form of *S. lindborgi* reported by Dr. Petrunkevitch from Puerto Rico is the female of *S. longipes*.

Family THOMISIDAE

Genus Misumenops F. O. P. Cambridge 1900

Misumenops bellulus (Banks)

Misumena bellula Banks, 1896, p. 71. "♀ Funta Gorda, Fla."
12 ♂ St. Croix, (Beatty)

Family CLUBIONIDAE

Genus Chiracanthium C. Koch 1839

Chiracanthium inclusum (Hentz)

Clubiona inclusa Hentz, 1847, p. 51, pl. 23, fig. 18. "♀ South Carolina, North Carolina, etc."
♂ 2 ♀ St. Croix, (Beatty)

Genus Aysha Keyserling 1891

Aysha tenuis (L. Koch)

Anyphaena tenuis L. Koch, 1866, p. 211, pl. 9, fig. 140. "♀ St. Domingo"
♂ ♀ St. Croix, (Wilson)
9 ♂ 8 ♀ St. Croix, (Beatty)

Genus Corinna C. Koch 1842

Corinna antillana spec. nov.

Figure 33

Female. Length, 11.2 mm. without mand., ceph. 5.4 mm. long, 3.5 mm. wide, abd. 5.4 mm.

Cephalothorax mahogany-red, darker about eyes, roughened, thoracic groove very distinct; *eyes* cover three-quarters width of head, anterior row straight, a.m.e. largest of the eight, separated by two-thirds of a diameter and from a.l.e. by a diameter and a half, posterior

row straight, little longer than anterior row, eyes subequal, p.m.e. separated by a diameter and a half and from p.l.e. by two diameters and a half; *quadrangle* of median eyes slightly wider in front and not as high as wide; *clypeus* less than a radius of a.m.e.; *mandibles* darker than cephalothorax, roughened, geniculate, boss large, fang groove short, superior margin with three teeth, inferior margin with three large teeth followed by one much smaller, fang short with a thick base; *labium* about as wide as long; *maxillae* not quite twice as long as labium, lateral margins almost parallel; *sternum* rebordered on lateral margins, two-thirds as wide as long, IV coxae separated by half a diameter; *abdomen* a gray-brown, slightly darker at base, cylindrical; *legs*, 4–1–2–3, yellow with distal joints darker, spines, I pair, patella, 0, tibia, dorsal, 0, lateral, 0, ventral, 2–2–2–2–2, metatarsus, dorsal, 0, lateral, 0, ventral, 2–2, with a single median spine at tip, II pair, tibia, ventral, 2–2–2, lr, metatarsus, ventral, 2–2, 1 median apical spine, all metatarsi with ventral apical spine; *epigynum*, large, posterior portion strongly chitinized, anterior portion convex.

Holotype ♀ St. Croix, (Beatty)

Two other species of *Corinna* have been reported from the Virgin Islands. *C. humilis* (Keys.), known from both male and female, has three pairs of ventral spines on the first tibia and two pairs on the metatarsus. *C. eleonei* Petr. known only from the type(♀), has four pairs of spines on the first tibia and two pairs on the metatarsus. *C. antillana* has but three large teeth and one small tooth on the inferior margin of the fang groove but it has five pairs of spines beneath the first tibia and two pairs on the metatarsus and a small median apical spine. Simon described seven species of *Corinna* from St. Vincent, and one has the single apical spine on the metatarsi, although several have three pairs of spines on the first metatarsus.

Corinna humilis (Keys.)

Hypsinotus humilis Keyserling, 1887, p. 446, pl. 6, fig. 18. "♂ ♀ St. Kitts"
Corinna humilis Petrunkevitch, 1926, p. 30, 4 ♀

2 ♀ St. Croix, (Beatty)

Family SALTICIDAE

Genus SIDUSA Peckham 1895

SIDUSA PAVIDA spec. nov.

Figures 34, 40

Male. Length, 3.0 mm., ceph. 1.6 mm., abd. 1.5 mm.

Cephalothorax brown, almost black about the eyes, with a paler median stripe from dorsal eyes to posterior margin, eye area thickly covered with short white hairs, thoracic groove very short, in a small depression slightly posterior to dorsal eyes, cephalothorax moderately high, highest at dorsal eyes where it continues in same plane half way to margin and then falls rapidly, sides vertical; *eyes*, anterior row recurved, a.m.e. twice the diameter of a.l.e., separated by a line and from a.l.e. by a little more, second row midway between first and third rows, dorsal eyes and a.l.e. subequal, not quite on extreme margin of carapace; *quadrangle* of eyes about two-fifths as wide as long and narrower behind; *clypeus* inclined inward, pale, covered with white scales, almost as wide as diameter of a.m.e.; *mandibles* pale, vertical, anterior surface flat, fang groove very short, transverse, superior margin with two small, black subequal teeth at median margin, best seen from front view, inferior margin not defined and with no tooth, fang from a thick base and longer than groove; *labium* pale, longer than wide; *maxillae* twice as long as labium; *sternum* small, truncate at both ends, two-thirds as wide as long, convex, pale shaded with gray; *abdomen* pale, with a pair of dark lateral stripes with an irregular median margin which forms three pairs of white spots, the largest of which is posterior to middle, median area and sides covered with white hairs, venter pale; *legs*, 4–1–2–3, all patellae with prolateral and retrolateral spines, anterior tarsi and metatarsi subequal, pale, I pair with a broad prolateral dark stripe on patella and tibia, spines, I pair, tibia, dorsal, 0, prolateral, 2, retrolateral, 1 small basal, ventral, 2 apical, 2 median, 1r, metatarsus, dorsal, 0, prolateral, 0, retrolateral, 0, ventral, 2–2, basal pair much more than half the length of the joint, II pair, tibia, dorsal, 0, prolateral, 2, retrolateral, 0, ventral, 2, 1r, 1r, metatarsus, ventral, 2–2, III and IV pairs spiny, tibiae with dorsal basal spine; *palpus*, basal joints pale, not as long as cephalothorax, femur not enlarged, tibia longer than patella, swollen so that it is almost as wide as long, prolateral half covered with short, black hairs, retrolateral with long white hairs, tibial apophysis long, parallel to cymbium, suddenly contracting and ending in a long bristle like tip, embolus a slightly curved spine on opposite side from tibial apophysis.

Holotype ♂ St. Croix, (Beatty)

The generic position of *pavida* is uncertain, but it can be placed in the genus *Sidusa* as construed by F. O. P. Cambridge in the Biol. Centr. America, 1901, **2**, p. 196. In it, he placed several of the Peckham genera, irrespective of the number of teeth on the inferior margin of the fang groove, but always with two teeth on the superior margin. According to Simon, all tibiae in the genus *Sidusa* have a dorsal basal spine. Cambridge states that the spine is always found on the posterior pairs but is often missing on the anterior. This species cannot be placed in the genus *Stoidis* Simon, 1901, as the III and IV pairs of legs are not subequal and the clypeus is fairly high and covered with hairs.

Genus Plexippus C. Koch 1850

Plexippus paykulli (Audouin)

Attus paykulli Audouin, in Savigny, Descr. Egypte, Nat. Hist., 1826, **1**, p. 172. "♂ Egypte"

Plexippus paykulli Petrunkevitch, 1926, p. 21, 31.
♂ St. Croix, 14 March 1922, (Wilson)

Genus Corythalia C. Koch 1850

Corythalia iridescens Petr.

Corythalia iridescens Petrunkevitch, 1926, p. 69, figs. 23, 24. "♂ ♀ St. Thomas"

Through the kindness of Dr. Shoemaker, I have been able to examine the types. The species belongs to the genus *Corythalia* in the broad sense, as the third pair of legs are longest and they have a heavy fringe of hairs, but the embolus is not curved. It is apparently subject to great variation in size. The patellae are flattened dorsally, possibly more in the female than in the male. In the male palpus, the patella is half as long as the femur, dorsally flattened and thickly covered with white iridescent scales, tibia seen from above, is less than half as long as patella, with a slender retrolateral apophysis and a ventral apophysis that is not quite at the tip, half hidden by dark hairs and best seen from a lateral view.

Genus Hentzia Marx 1883

Hentzia antillana Bryant

Hentzia antillana Bryant, 1940, p. 494, figs. 285, 289, 294. "♂ ♀ Antigua" ♂ ♀ St. Croix, (Beatty)

Genus Stridulattus Petrunkevitch 1926

Stridulattus stridulans Petr.

Stridulattus stridulans Petrunkevitch, 1926, p. 74, figs. 25–28. "♂ St. Thomas, July 1915"

Through the kindness of Dr. Shoemaker, I have been able to examine the type, the only specimen known.

The genus has been misplaced and it belongs near *Marpissa*, rather than *Heliophanes*. The diagnosis is misleading; the first coxae are described as far apart but in the description of the species, the coxae are separated by the width of the labium. The latter is correct, as they are separated by a little over a diameter. The sternum is distinctly narrowed between the first coxae. In the Biol. Centr. America, the relative length of the sternum is used to separate genera, but this is a character that does not always hold in all species. There is also a reduction of spines on all legs, both in size and number. On the right first leg, the tibia has one retrolateral spine, a ventral apical pair followed by two on the inner side; the left leg has an additional spine opposite the inner basal spine. All the spines are small and the posterior metatarsi have an apical whorl only.

Genus Menemerus Simon 1868

Menemerus kochi spec. nov.

Figure 30

Female. Length, 4.5 mm., ceph. 2.4 mm., abd. 2.1 mm.

Cephalothorax dark brown, much darker about the eyes, with a rather broad lateral stripe that does not meet at posterior margin, a median stripe of white hairs from a little anterior to thoracic groove to near the posterior margin, moderately high, widest posterior to dorsal eyes, cephalic portion rather flat, a shallow depression between dorsal eyes in which is the short thoracic groove; *eyes*, anterior row slightly recurved, eyes equidistant, a.m.e. large, separated by little more than a line, a.l.e. less than a radius of a.m.e., second row nearer the first than the third row, dorsal eyes convex, subequal with a.l.e., not on extreme margin of carapace; *quadrangle* as wide in front as behind;

clypeus thickly covered with white hairs, narrow, less than a radius of a.m.e.; *mandibles* brown, robust, vertical, fang groove slightly oblique, superior margin with two contiguous black teeth, inferior margin with one black tooth, fang little longer than groove with a thick base; *labium* longer than wide; *maxillae* almost twice as long as labium; *sternum* anteriorly narrowed to width of labium, which is less than a diameter of I coxa, widest between II and III coxae, where it is about half as wide as long, truncate in front of IV coxae; *abdomen* oval, dorsum flat, covered with short pale hairs and longer black ones, a wide white basal band which does not extend on sides, posterior part an orange-red, a white median stripe that just touches basal band, widest posterior to middle, with posterior third much narrowed and broken by three dark chevrons, sides dark, venter pale with dark spots in a median and lateral stripes, area between, with scattered dark spots, largest a pair just anterior to spinnerets, spinnerets long and closely grouped; *legs*, 4–1–2–3, I pair enlarged, femur flattened laterally, femur pale with a wide dark distal band, patella, tibia and metatarsus brown, tarsus pale, spines, patella, 0, tibia, dorsal, 0, lateral, 0, ventral, 2–2–2, metatarsus, dorsal, 0, lateral, 0, ventral, 2–2, II pair colored as I pair, spines, patella, prolateral, 1, tibia, ventral, 2–2–1r, metatarsus, ventral, 2–2, III and IV pairs, brown, spines, patella, prolateral, 1, retrolateral, 1, tibia, scattered, no dorsal, basal spine, metatarsus, 2 whorls, apical and median; palpi pale, with a distinct dark spot at base of three terminal joints; *epigynum* a pair of transverse oval openings anterior to dark sacs beneath the skin, a median inverted chitinized V above the fold separates the sacs.

Holotype ♀ St. Croix, (Beatty)

In 1846, C. Koch described *Marpissa incerta* (♀) from St. Thomas. This has never been found since. It is a little larger than this species, and the description was made when the specimen was dry. It varies in several points other than size, and probably it is not *Menemerus kochi*. Koch describes and figures this species with narrow lateral stripes on the cephalothorax and a wider stripe on anterior portion ending below the dorsal eye, no median stripe. The abdomen is all dark with a narrow lateral white stripe from base to spinnerets and the legs reddish-yellow. No mention is made of the conspicuous dark spots on the palpi.

Genus Habronattus F. O. P. Cambridge 1901

Habronattus brunneus var. insignis var. nov.

Figures 35, 38

Male. Length, 4.6 mm., ceph. 2.6 mm., abd. 2.3 mm.

Cephalothorax, ocular area thickly covered with white scales and longer dark hairs, sides chestnut-brown, a median brown triangle from posterior margin with apex at groove, each side are inverted triangles of white scales, a narrow marginal line of white scales from below dorsal eyes, sides rounded, widest posterior to dorsal eyes, a recurved depression posterior to eyes; *eyes*, anterior row straight by upper margins, a.m.e. almost touching, a.l.e. about a radius of a.m.e. and separated from them by twice the space between a.m.e., small eyes about midway between first and third rows, dorsal eyes not on extreme margin of carapace and subequal with a.l.e.; *clypeus* covered with white scales, about a diameter of a.m.e. and retreating; *mandibles*, small, cone-shaped and weak, inferior margin with one sharp tooth; *abdomen* oval, dorsum flat, dark, with a broad basal white band that narrows on sides and reaches the spinnerets, a median basal spear mark of white scales that reaches middle, where it connects with a pair of narrow transverse bars, a median white triangle on posterior half and two pairs of widely separated lateral white dots, between basal mark and posterior triangle an indistinct pale chevron, venter pale with a median dark stripe that is widest anterior to spinnerets and heavier lateral stripes that do not reach the middle; *legs*, 3–4–1–2, with I and III pairs modified, all patellae with prolateral and retrolateral spines, I pair dark, with a median stripe of white scales on femur and patella, femur with a prolateral brush of dark hairs with longer white pedicellate hairs, heaviest at distal half and a smaller brush on retrolateral side, ventral side with pedicellate white hairs, patella with prolateral and retrolateral tufts of hairs, tibia with scattered dorsal white scales, a prolateral and a retrolateral brush of dark hairs with longer white pedicellate hairs, metatarsus and tarsus dark, spines, tibia, with two long, heavy, prolateral fusiform spines, metatarsus, ventral, 2–2, II pair, dark with white scales, III pair, femur pale, with a large prolateral dark spot from base to near tip, tip swollen, pale, with a prolateral dark spot that bares a spine, swollen area with a thick dorsal crest of fawn-colored hairs, patella pale, dorsal, distal end modified by two processes, as in *coronatus*, distal process very slender, spines, tibia, dorsal, small median basal spine, ventral, a long, median basal colorless spine; *palpus*, pale, with white scales, tibia shorter than patella, tibial apophysis dark, heavy with a

blunt tip, palpal organ of usual type, bulb convex, circular with the two processes starting near the base on prolateral side, the outer ending at tip.

Female. Length, 7.0 mm., ceph. 3.1 mm., abd. 4.0 mm.

Cephalothorax brown, covered with white scales, thickest on ocular area, where there are also scattered long black hairs, no indications of the white triangles or marginal line found in the male, sides rounded, recurved depression posterior to dorsal eyes; *eyes* same as in male; *clypeus* thickly covered with white scales; *mandibles* same as in male; *abdomen* brown, thickly covered with white scales and longer dark hairs, the posterior white triangle and the posterior pair of lateral spots can be traced, venter, pale with the three dark stripes as in the male; *legs*, 3–4–1–2, not modified, I pair heaviest, brown with scattered white scales, spines, patella, 0, tibia, dorsal, 0, lateral, 0, ventral, 2–2–2, not opposite, retrolateral spines very short, metatarsus, dorsal, 0, lateral, 0, ventral, 2–2, other pairs paler, II patella, 1 retrolateral spine, III tibia, dorsal, no median basal spine, ventral, a median basal spine, dark and not as long as in the male, posterior patellae with prolateral and retrolateral spines; *epigynum* with a median transverse opening followed by diverging dark areas beneath the skin, as in *coronatus*.

Holotype ♂ St. Croix, summer of 1941, (Beatty)

Allotype ♀ St. Croix, summer of 1941, (Beatty)

Paratypes 3♂ St. Croix, summer of 1941, (Beatty)

The type of *Habronattus brunneus* is from Key West, Florida and is in the museum collection. The variety *insignis* agrees in many ways with the type but differs from it principally in color and the secondary characters. The Florida specimen is brown, with no lateral triangles of white hairs on the cephalothorax, possibly from age, although there is no mention of them in the original description. The sternum, coxae and venter are dark brown, so that the four white stripes on the venter are quite conspicuous. It also has a much denser row of dark hairs above the anterior eyes. The variety *insignis* has an almost white sternum, coxae and venter and the four pale stripes mentioned by Peckham are poorly defined. But the difference is most noticeable in the secondary characters; the lateral brushes of dark hairs on the first tibia are heavier, the third leg is longer, with the distal end of the femur more swollen with a larger crest of fawn-colored hairs and the apophyses on the patella are larger. Both have the long colorless ventral spine on the third tibia and the bulb of the palpus is convex, rather than flat. The ventral spine on the third tibia was not noted in earlier descriptions. The female has never been described before.

Unfortunately the original figure of the palpus of *brunneus* is inaccurate. There are two dark spines, as is usually found in the genus, that closely follow the contour of the cavity and are parallel. The drawing shows but one. The tibial apophysis is dark and heavy.

APPENDIX

Other Spiders Reported from the Virgin Islands

For the sake of completeness, all other spiders reported from the Virgin Islands are given below in a systematic list. In no case have the specimens been examined. An asterisk (*) before the name indicates one of the Virgin Islands as the type locality. In every case, the author and the year of the description are given. A second name and date is a reference to the person reporting the species from there.

Sub-order MYGALOMORPHAE

Family CTENIZIDAE

PHAEOCLITA FAUNA Simon, 1889; Petrunkevitch, 1926

Family DIPLURIDAE

*MYGALE DRASSIFORMIS C. Koch, 1842 "St. Thomas"

*DIPLURA MACRURA (C. Koch), 1842 "St. Thomas"

Family BARYCHELIDAE

*OBAERARIUS INSULANUS Petr., 1926 "♀ St. Thomas"

Family THERAPHOSIDAE

*CYRTOPHOLIS ACUTISPINA Strand, 1907 "St. Thomas"

CYRTOPHOLIS BARTHOLOMEI (Latreille), 1832; Petrunkevitch, 1926

*ISCHNOCOLUS SHOEMAKERI Petr., 1926 "♀ St. Thomas"

Sub-order ARACHNOMORPHAE

Family DYSDERIDAE

*ARIADNA ARTHURI Petr., 1926 "immat. ♀ St. Thomas"

Family SICARIIDAE

LOXOSCELES RUFIPES (Lucas), 1834; Petrunkevitch, 1926

Family PHOLCIDAE

Modisimus glauca Simon, 1893; Petrunkevitch, 1926

Family THERIDIIDAE

Theridion tepidariorum C. Koch, 1841; Petrunkevitch, 1926

Family ULOBORIDAE

*Miagrammopes ciliatus Petr., 1926 "♀ St. Thomas"

Family ARGIOPIDAE

Araneus nauticus (L. Koch), 1875; Petrunkevitch, 1926

Leucauge mandibulata F. O. P. Cambr., 1903; Petrunkevitch, 1926

Micrathena militaris (Fabr.), 1775; Petrunkevitch, 1926

Micrathena sagittata (Walck.), 1837; Petrunkevitch, 1926

Family CTENIDAE

*Odo agilis Simon, 1896 "St. Thomas"

Family GNAPHOSIDAE

*Trochanteria ranumcula Karsch, 1879 "♂ ♀ Sta. Cruz."

Family SPARASSIDAE

Olios fasciculatus Simon, 1880; Petrunkevitch, 1926

Family CLUBIONIDAE

*Clubiona maritima L. Koch, 1866 "♀ St. Thomas"

*Corinna cleonei Petr., 1926 "♀ St. Thomas"

Family SALTICIDAE

*Evophrys vetusta C. Koch, 1846 "immat. ♀ St. Thomas"

*Marpissa incerta C. Koch, 1846 "♀ St. Thomas"

Menemerus bivittatus (Dufour), 1831; Petrunkevitch, 1926

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EXPLANATION OF PLATES

PLATE 1

PLATE 1

Fig. 1 Dysderina antillana spec. nov., male, cephalothorax.
Fig. 2. Oonopinus pretiosus spec. nov., female, sternum.
Fig. 3. Telchius placidus spec. nov., male, cephalothorax.
Fig. 4. Telchius placidus spec. nov., left palpus, retrolateral view.
Fig. 5. Stenoonops nitens spec. nov., left palpus, retrolateral view.
Fig. 6. Scaphioides reducta spec. nov., epigynum.
Fig. 7. Dysderina antillana spec. nov., left palpus, ventral view.
Fig. 8. Scaphioides reducta spec. nov., female, cephalothorax.
Fig. 9. Oonopinus pretiosus spec. nov., female, cephalothorax.
Fig. 10. Stenoonops nitens spec. nov., male, cephalothorax.
Fig. 11. Gamasomorpha perplexa spec. nov., male, cephalothorax.
Fig. 12. Gamasomorpha perplexa spec. nov., left palpus, ventral view.
Fig. 13. Hytanis pusilla spec. nov., female, cephalothorax.
Fig. 14. Hytanis pusilla spec. nov., female, venter.

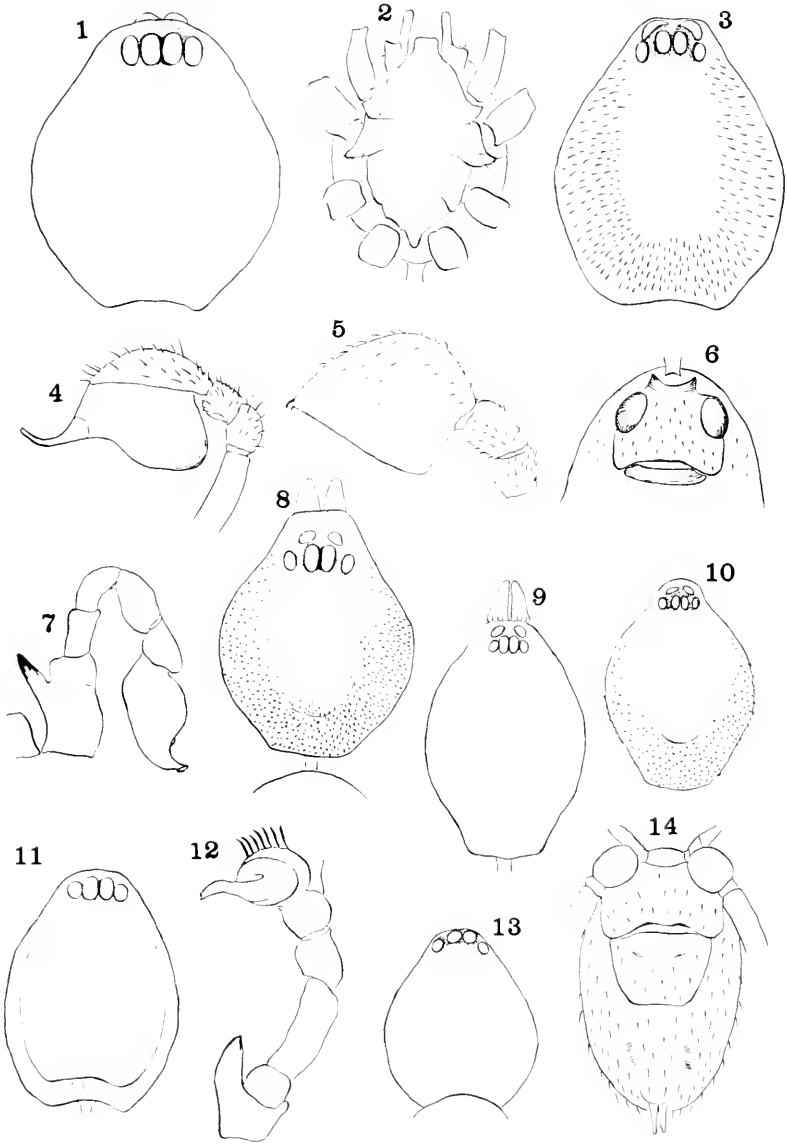
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PLATE 2

PLATE 2

Fig. 15. Conopistha nephilae (Tacz.), left palpus, ventral view.
Fig. 16. Lycosa subtilis spec. nov., left palpus, ventral view.
Fig. 17. Caponina blanda spec. nov., left palpus, retrolateral view.
Fig. 18. Gamasomorpha perplexa spec. nov., left palpus, retrolateral view.
Fig. 19. Lycosa subtilis spec. nov., epigynum.
Fig. 20. Thallumetus parvulus spec. nov., left palpus, retrolateral view.
Fig. 21. Conopistha cambridgei (Keys.), male, eyes, lateral view.
Fig. 22. Thallumetus parvulus spec. nov., female, spinnerets.
Fig. 23. Thallumetus parvulus spec. nov., male, eyes and mandibles.
Fig. 24. Conopistha cambridgei (Keys.), left palpus, ventral view.
Fig. 25. Lycosa reducta spec. nov., epigynum.
Fig. 26. Conopistha nephilae (Tacz.), male, eyes, lateral view.

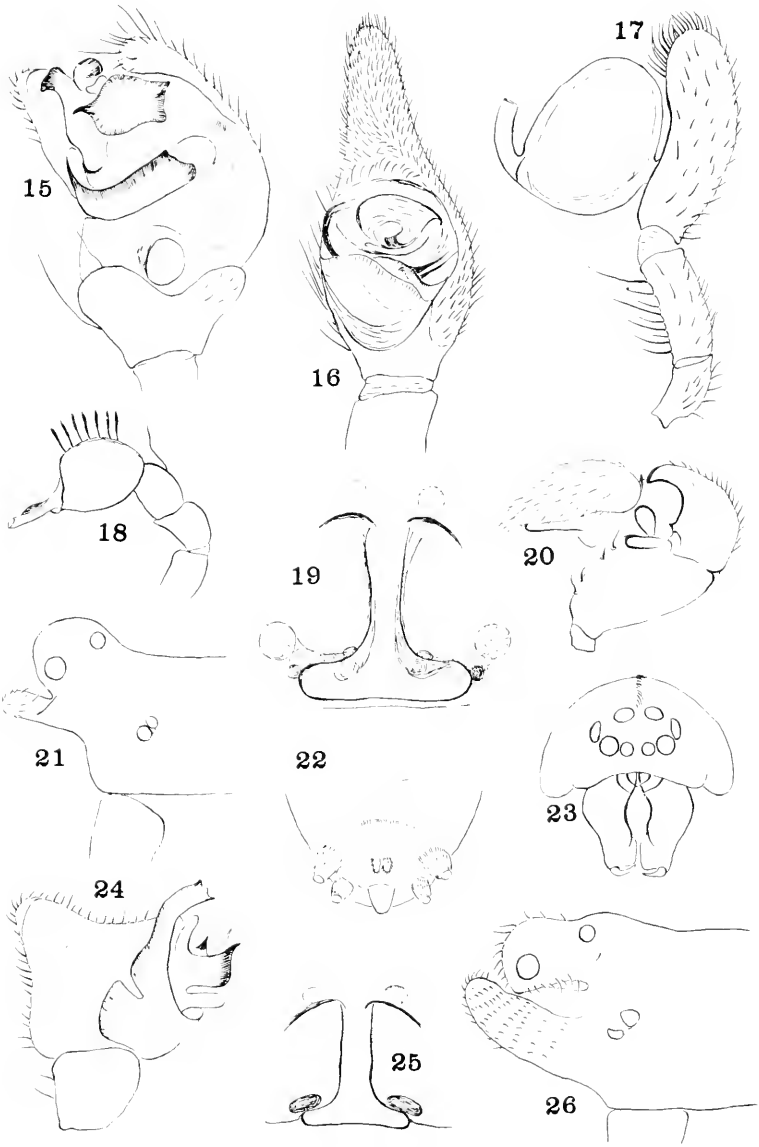
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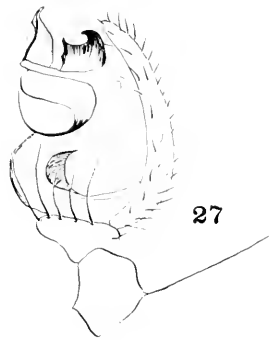
PLATE 3

PLATE 3

Fig. 27. Theridion virginus spec. nov., left palpus, ventral view.
Fig. 28. Theridion brevipalpus spec. nov., male, front view of eyes.
Fig. 29. Selenops lindborgi Petr., left palpus, ventral view.
Fig. 30. Menemerus kochi spec. nov., epigynum.
Fig. 31. Theridion brevipalpus spec. nov., male, right I femur, ventral view.
Fig. 32. Theridion brevipalpus spec. nov., left palus, ventral view.
Fig. 33. Corinna antillana spec. nov., epigynum.
Fig. 34. Sidusa pavida spec. nov., left palpus, dorsal view of tibial apophysis.
Fig. 35. Habronattus brunneus var. insgnis var. nov., epigynum.
Fig. 36. Theridion guanicae Petr., left palpus, ventral view.
Fig. 37. Selenops lindborgi Petr., epigynum.
Fig. 38. Habronattus brunneus var. insignis var. nov., left palpus, ventral view.
Fig. 39. Theridion cybele spec. nov., epigynum.
Fig. 40. Sidusa pavida spec. nov,. left palpus, ventral view.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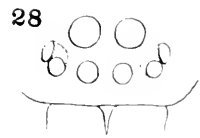
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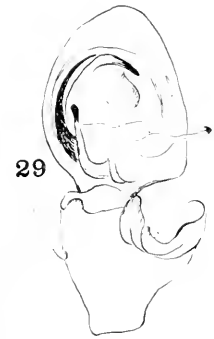
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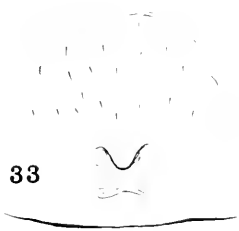
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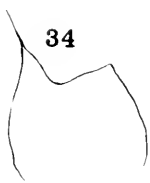
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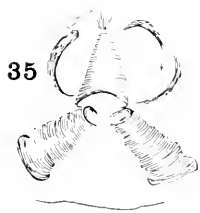
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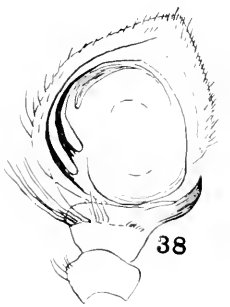
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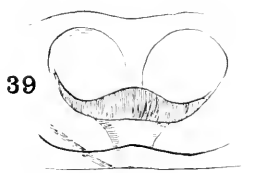
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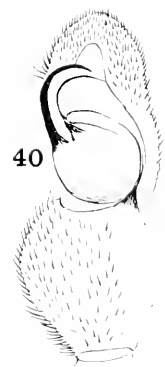
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Bulletin of the Museum of Comparative Zoölogy
AT HARVARD COLLEGE
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THE ECHINODERM FAUNA OF BERMUDA

BY HUBERT LYMAN CLARK

WITH ONE PLATE

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No. 8. — *The Echinoderm Fauna of Bermuda*

By Hubert Lyman Clark

In 1888 appeared the first list of Bermudan echinoderms, that of Professor Angelo Heilprin of the Philadelphia Academy of Natural Sciences, who took a party of students to the islands in the summer of that year. Their collections contained 6 nominal kinds of holothurians (now believed to represent only 4 valid species), 2 sea-stars, 6 brittle-stars and 6 sea-urchins, a total of 20 species. The list was published in December, 1888, in the Proceedings of the Academy of Natural Sciences. In September, 1898, I published "Notes on the Echinoderms of Bermuda," based on collections made by Professor C. L. Bristol of New York University in the summer of 1897. This appeared in the Annals of the New York Academy of Sciences (**11**, pp. 407–413) and includes 28 species but at least 5 of the holothurians were of doubtful validity. Further collections by Professor Bristol's students in 1898 led to my publishing a revised list in July, 1899 (see Annals N. Y. Acad. Sci., **12**, pp. 117–138), containing 29 species, but one of these is a synonym, one is only the young of another and a third is incorrectly identified. In April, 1899, I spent two weeks in Bermuda, and in June and July, another party from New York University was in the field. This field work led to my publishing a third paper entitled "Bermudan Echinoderms" (see Proc. Boston Soc. Nat. Hist., **29**, pp. 339–344, May, 1901) which also includes 29 species and corrects errors in the earlier lists.

Meanwhile Professor A. E. Verrill had begun his series of papers on the Bermudas and their fauna, which added much to our knowledge of the echinoderms. His first contribution appeared in the Transactions of the Connecticut Academy of Arts and Sciences, **10**, pp. 583–587, in the fall of 1900 (the signatures are dated both September and October, though the cover says September) and is called "Additions to the Echinoderms of the Bermudas", using my first list as the basis for the additions. These were chiefly brittle-stars, several of which were not taken by the Yale party, but rest on earlier and dubious records. The "*Synapta viridis*" listed is synonymous with *Synaptula hydriformis*. In October, 1901, in the same journal (**11**, pp. 35–37) a second contribution appeared, called "Additions to the Fauna of the Bermudas", which lists 5 species of echinoderms, taken by the Yale Expedition in the spring and early summer of 1901. Only one of these species is an addition to previous lists. In April 1907, further notes on the echinoderms of Bermuda with special reference to habits and

habitats appeared in volume XII of the Transactions. On pp. 100–102 are references to the various holothurians and echini which secure their nourishment by passing mud and sand through the alimentary canal. A sea-star and a brittle-star are also discussed in connection with their sandy habitat. On pp. 275–285, a list is given of the Echinoderms found on or about corals and the coral reefs, with notes as to their occurrence and habits. Altogether in these lists of 1907, Verrill reports a total of 36 species of Echinoderms in the Bermudan fauna.

In 1919, in a paper on the Distribution of the Littoral Echinoderms of the West Indies (Carnegie Inst., Publ. 281, pp. 49–74), I listed 42 species from Bermuda, but 2 or 3 of these are unquestionably mistakes. In 1922, my "Echinoderms from the Challenger Bank, Bermuda" (Proc. Amer. Acad., **57**, pp. 353–361, pl. 1) appeared, listing 13 species, but only 8 of these are as yet known from Bermuda. In 1933, my "Handbook of the Littoral Echinoderms of Porto Rico and the other West Indian Islands" was published by the New York Academy of Sciences (Sci. Survey of Porto Rico, **16**, pt. 1), with a list of 41 Bermudan species on p. 124. This however includes as an inexcusable error, a mythical species "*Ophiozona imbricata*"; presumably *Ophiozona impressa*, long ago listed from Bermuda but apparently by error, as it has not been taken in the past half century.

In April, 1939, I enjoyed a stay of 18 days at the Bermuda Biological Station, during which I did shore collecting at ten different localities, most of which were new to me. There was also one brief dredging trip in Ferry Reach. The best collecting for echinoderms I found at Hungry Bay, on the south shore, where 20 species were taken during my three visits. Only 8 additional species were secured at all of the other places visited. I am under great obligations to Dr. J. F. G. Wheeler for the hospitality of the Station and for his constant readiness to assist me in every way he could. Particularly I have to thank him for calling my attention to the strange occurrence of *Synaptula hydriformis* in Lovers Lake; for the opportunity to measure and examine carefully a Bermudan specimen of *Mellita quinquiesperforata;* and for his generous gift of a Bermudan Oreaster, the only one I have ever seen. Dr. H. B. Moore was also assiduous in aiding me, particularly in getting living specimens of *Leodia sexiesperforata*, and *Eucidaris tribuloides*. In the summer of 1941, Dr. Moore kindly sent me semi-fossil remains of several species of echini secured by the dredging operations in Castle Harbor. Among these were two recognizable tests of the spatangoid *Moira atropos*, not previously known from Bermuda. To Dr. E. F. Thompson and Dr. Marie V. Lebour, I am much in-

debted for encouragement and help. I wish to acknowledge also the great kindness of Mr. L. S. Mowbray of the Bermuda Aquarium at Flatts in making a day's collecting at Gravelly Bay and in Harrington Sound possible and successful. He furthermore showed me some important specimens of Echini in the new Museum. It is a pleasure to give my hearty thanks to all of these friends who did so much to make our Bermudan visit of 1939 as profitable as pleasant.

In presenting the following revised list of the Echinoderms of Bermuda, it may be well to mention first those species previously listed whose names will not be found in the following pages, and explain the cause of their absence. There are 9 of these, as follows:

Nemaster iowensis — erroneously listed from "Bermuda" instead of "Bahamas."
Ophidiaster guildingii — erroneously listed instead of *Linckia guildingii*.
Ophiactis mülleri — listed by Verrill for *mülleri* Ltk. but there is no record of that species from Bermuda.
Ophiopsila riisei — no reliable record from Bermuda.
Ophiura brevispina — no reliable record from Bermuda.
Ophiozona imbricata — *lapsus calami* for *O. impressa*.
Ophiozona impressa — no reliable record from Bermuda.
Holothuria floridana — no reliable record from Bermuda. Heilprin's record apparently refers to *H. surinamensis*.
Leptosynapta inhaerens — mistaken identification.

The following 36 names (arranged alphabetically) occur in one or more of the earlier lists but are now considered synonyms of more correctly applied names.

Actinopyga parvula	= *Holothuria parvula*
Amphipholis goesi	= *Amphipholis gracillima*
Amphipholis tenera	= *Amphipholis squamata*
Asterias atlantica	= *Stolasterias tenuispina*
Asterias tenuispina	= *Stolasterias tenuispina*
Astroporpa affinis	= *Asteroporpa annulata*
Chondroeloca vivipara	= *Synaptula hydriformis*
Cidaris tribuloides	= *Eucidaris tribuloides*
Coscinasterias tenuispina	= *Stolasterias tenuispina*
Cucumaria punctata	= *Thyone surinamensis*
Diadema setosum	= *Centrechinus antillarum*
Echinoneus semilunaris	= *Echinoneus cyclostomus*
Hipponoë esculenta	= *Tripneustes esculentus*
Holothuria abbreviata	= *Holothuria parvula*
Holothuria captiva	= *Holothuria parvula*

Holothuria rathbuni	= *Holothuria arenicola*
Leptosynapta acanthia	= *Eupatinapta acanthia*
Leptosynapta roscola	= *Epitomapta roscola*
Mellita sexforis	= *Leodia sexiesperforata*
Mellita sexiesperforata	= *Leodia sexiesperforata*
Ophiactis krebsii	= *Ophiactis savignyi*
Ophiactis lymani	= *Ophiactis algicola*
Ophiocoma crassispina	= *Ophiocoma echinata*
Ophiura appressa	= *Ophioderma appressum*
Ophiura brevicauda	= *Ophioderma brevicaudum*
Ophiura cinerea	= *Ophioderma cinereum*
Semperia bermudensis	= *Thyone surinamensis*
Stichopus diaboli	= *Stichopus badionotus* forma *diaboli*
Stichopus moebii	= *Stichopus badionotus*
Stichopus xanthomela	= *Stichopus badionotus* forma *xanthomela*
Synapta acanthia	= *Eupatinapta acanthia*
Synapta inhaerens	= *Leptosynapta inhaerens* (non-Bermudan)
Synapta roscola	= *Epitomapta roscola*
Synapta viridis	= *Synaptula hydriformis*
Synapta viripara	= *Synaptula hydriformis*
Toxopneustes variegatus	= *Lytechinus variegatus*

Making due allowance then for these errors and synonyms, 48 species of Echinoderms are now known from Bermuda itself, not including Challenger Bank. This group of 48 is made up of 5 species of sea-stars, 18 brittle-stars, 12 echini and 13 holothurians. Artificial keys to aid in identifying these species will be found in the "Handbook of the Littoral Echinoderms of Porto Rico, etc." mentioned above (p. 3, lines 11–14), excepting only one or two deep water forms.

CRINOIDEA

Feather-stars

In 1907, Verrill recorded "a single specimen" of Antedon "too young for accurate identification" which "was obtained in 1901". This is apparently the only crinoid that has as yet been found in the Bermudas. In 1919, I recorded *Nemaster iowensis* (Springer) from Bermuda on the strength of Mr. A. H. Clark's statement that he had a specimen from there. Subsequently Mr. Clark discovered that his specimen was from the Bahamas and not from Bermuda. Obviously a crinoid fauna is practically wanting in the Bermudas.

ASTEROIDEA

Sea-stars

The scarcity of sea-stars in the marine fauna of Bermuda is one of its striking features. While 5 species are now known to occur, only one, Stolasterias, is at all common. Just why this should be so is not easy to understand, but it may be remarked that the entire West Indian littoral fauna contains but 17 species of sea-stars as compared with 40 in the Torres Strait region. The fauna from which Bermuda has derived her sea-stars is thus itself somewhat depauperate. It is hard to see, nevertheless, why Astropecten and Echinaster should not occur, since they are common on the shores of the southeastern United States and in the Bahama Islands. On the other hand, Stolasterias which occurs commonly at Bermuda, is unknown on the coast of the United States and is virtually unknown in the West Indies; a record from Cuba needs confirmation. It is common in the Mediterranean and the eastern Atlantic and it seems very probable that it reached Bermuda on foul ship bottoms.

1. Luidia clathrata (Say)

This sea-star lives on sandy bottoms, where it may be more or less completely buried beneath the surface. It is not strange therefore that it was not taken until 1898, when a party from New York University secured a specimen in Harrington Sound; the color of this individual was said to have been "salmon-pink" in life. The following year another party from the same University was located on Whites Island in Hamilton Harbor and secured "several specimens on the beach", but these were blue-gray above and cream-color beneath — the usual coloration of specimens from the Carolinas, Florida and the West Indies.

In 1901 Verrill reported: "Several fine specimens of this species were taken on a white shell-sand bottom in shallow water, at Trunk Island, Harrington Sound. It also occurred at Long Bird Island and other localities on shell-sand bottoms in shallow water. Its presence is indicated by a star-shaped impression in the sand. But it moves about under the sand with remarkable rapidity, when disturbed, by means of its large ambulacral tubes, so that it is not easy to capture it after it has taken alarm. Its color in life is generally light cream-color often with a rosy or flesh-colored tint and frequently with a darker grayish

or greenish median streak on each ray. It becomes at least a foot in diameter at Bermuda."

In 1906, Verrill again refers to Luidia as "common in some places, living under the surface of the sand. It is remarkable for the rapidity with which it can glide along, using its numerous large ambulacral feet as paddles or oars for swimming or gliding, while concealed just under the loose sand." In 1915, Verrill says of this Luidia: "Bermuda, common in sheltered situations just below low-tide level on bottoms of shell-sand, concealed just below the surface. All living specimens seen by me in Bermuda were either pale salmon or rose-salmon. Those from Florida and North Carolina are gray." He further repeats his earlier statements regarding the ease and rapidity of its movements and asserts further "It can also swim . . . free of the sand or on its surface" by means of "its large flattened muscular feet" which it "uses like paddles".

I have not been so fortunate as to meet with this sea-star alive in Bermuda, but have collected it on the Carolina coast and in Jamaica. The specimen taken by the New York University party in Harrington Sound, Bermuda, in 1898 is one of about 30 specimens in the M. C. Z. collection: it is a dull cream-color and has R = 140 mm. All very young individuals in the M. C. Z. collection are very light colored, practically without pigment. As size increases, pigment usually appears in the median part of the upper surface of each ray. As a rule it spreads over the whole abactinal surface, though deepest and darkest along the radial median area. In a few individuals, the pigment is confined to that area so definitely, that the dark longitudinal line on each ray stands out conspicuously against the unpigmented background. Pink or salmon tints have not been reported from any place but Bermuda and further, more detailed observations on this point should be made. Even more important are careful observations on the movements and possible swimming powers of Bermudan Luidias, as reported by Verrill. No living specimen seen by me has shown any activity whatever.

2. Oreaster reticulatus var. bermudensis, var. nov.

Figures 1 and 2

The occurrence of Oreaster at the Bermudas has never been definitely recorded, but a specimen presented by Dr. J. F. G. Wheeler to the M. C. Z. in April, 1939, establishes it beyond dispute. This specimen was detected with a water glass on the bottom of Ferry Reach and was

then brought up by a diver and given to Dr. Wheeler. It is very large and obviously senescent, but it is so strikingly different from any West Indian specimen of Oreaster seen, that it seems proper to give it a varietal name. It is now dry and shows the effects of handling. All the rays are turned upward at the tip but there is no doubt that in life R exceeded 170 mm. and r is even now nearly 90. The rays are very wide at base, 90 mm. or more, blunt and rounded at the tip; 20 mm. orad, the ray is 35 mm. wide but not much over 20 mm. high. Vertical diameter at center of disk is about 60 mm. Abactinal skeleton most irregularly and imperfectly reticulated; there are no regular series of tubercles and the papular areas are large, irregular and ill-defined. The central portion of the disk, a space 60–70 mm. in diameter, is rather definitely delimited by narrow skeletal plates bearing conical tubercles, 2–4 mm. high and 2–3 mm. in diameter at base; on these tubercles most of the cone is bare and smooth but the basal part is finely and evenly granulated. There are about 15 supero-marginal plates on each side of each ray but at the tip they are abruptly smaller, crowded and ill-defined. Each normal plate carries a conspicuous tubercle about 8 mm. high (or long), the terminal portion (5 mm. long by 4 mm. in diameter) bare and smooth; occasionally double, the tip is more or less pointed, but the point is often irregular and may be flattened laterally to a greater or less degree. Near the end of each ray, the tubercles on all plates are much smaller and more irregularly placed.

Inferomarginal plates, entirely on the oral surface, overshadowed by the superomarginals, which they resemble more or less but they often have 2, or even 3, cones and the granulation is distinctly coarser, at least on the orad side. The rest of the oral surface is covered by convex, granulated actinal intermediate plates, each of which carries one, or very often 2 smooth cones, 2.5–5 mm. high and 2–4 mm. thick at base. Granulation of these plates is largely made up of pedicellariae and since, in this specimen, the jaws of these pedicellariae have for the most part fallen out of their sockets, the granulation appears to be made up for the most part of deeply excavated circular or elliptical cups. Adambulacral armature heavy, a single series of 5 or 6 unequal, flat, truncate furrow spines, back of which a very large irregularly conical spine (or often two of them) covers the actinal surface of the plate; these spines are commonly more or less flattened parallel with the furrow and show great diversity of size and form. Oral armature made up of similar but blunter spines; it is too deeply sunken however to permit a description of its details.

Upper surface light reddish-brown, the large tubercles and tips of the arms lighter, often nearly white. The lower surface has evidently been bleached to some extent; the many bare plates are light reddish-brown while the spines and granules are pure white, as are many large actinal plates, which have lost their epidermis.

This peculiar Oreaster differs from all the specimens of *reticulatus* in the M. C. Z. in the short blunt rays, the entire lack of serial arrangement of spines or papulae on the upper surface and the large conical, usually single, spines on the actinal plates. There are several West Indian specimens at hand larger than this one, and at least one is as obviously senescent, but they do not look at all like the Bermudan specimen. For the present therefore it may well bear the varietal name suggested. Obviously further material is much to be desired.

3. Linckia guildingii Gray

(= *Ophidiaster guildingii* Verrill, 1900, p. 584, nox *Ophidiaster guildingii* Gray, 1840.)

This stiff and inert species has been taken many times in Bermuda, but it is not common anywhere. Adults are very rarely found, most of the individuals taken having the rays less than 100 mm. long. Small specimens often have 6 or rarely 7 rays but in adults 5 is the normal number. The species is tropicopolitan but the largest specimen yet recorded (M. C. Z. no. 2648) was taken July 2, 1903 at Bermuda; its longest ray is about 215 mm. The color of this sea-star shows extraordinary diversity as violet, bright blue, dull red variegated with lighter, and yellow-brown specimens are recorded. In Bermuda, however, the color seems to be always dull orange or yellow-brown. Large individuals occur lying exposed on sandy bottoms, but the great majority of specimens are found under rocks or concealed in crannies in the reef.

4. Asterina folium (Lütken)

Living on the under surface of rock-fragments near low water mark, this sea-star is easily overlooked. It is flat, pentagonal and rarely over 20 mm. across. Its color when adult is bluish-green or quite blue, of a light or dull shade. Young specimens may be cream-color or yellowish but they begin early to accumulate pigment dorsally. Asterina has been taken at Coney Island and in Castle Harbor, but apparently it is not very common.

5. Stolasterias tenuispina (Lamarck)

Although an eastern Atlantic and Mediterranean species, this Stolasterias, easily recognizable as a rule by having 6–8 unequal arms, is the one common sea-star in Bermuda. It probably came to the islands originally on foul ship bottoms. It is now common and widely distributed and grows to a fairly large size, but specimens with R exceeding 90 mm. are seldom seen. In April, 1939, Clark G. Myers collected a very symmetrical 7-armed specimen with R=75–100 mm. and later, in Harrington Sound, he took a less symmetrical 8-armed specimen, with R ranging from 60 to 110 mm.

The largest specimen in the M. C. Z. collection (no. 1369) is an old one, labelled as from Bermuda. It is symmetrically 5 rayed and R=135 mm. The history of this specimen is of more than ordinary interest, for it was collected by A. S. Bickmore of the Museum staff, when accompanying the celebrated P. T. Barnum on an expedition to the Bermudas in 1862. Professor Louis Agassiz, in his report of February, 1863, says: "We are indebted to Mr. P. T. Barnum for the facilities he has given to Mr. Bickmore of accompanying his expedition to Bermuda, during which Mr. B. has made an extensive collection of the marine animals of that island, showing that its fauna is identical with that of the coast of Florida."

OPHIUROIDEA

Brittle-stars

Although more than a third of the species of Bermudan echinoderms are brittle-stars, only a single species, *Ophionereis reticulata*, is so widely distributed and so common that it will be found by the casual collector. It was only on the fifth day of diligent search at or near low-tide level, in April, 1939, that we found a second species, *Ophiomyxa flaccida*, and we did not see it again in the following two weeks! On the south shore, at Gravelly Bay and Hungry Bay, the 3 species of Ophiocoma are fairly plentiful and *Ophioderma appressum* is not hard to find in Harrington Sound. The remaining dozen species are either small, secretive forms, seldom noticed unless search is being made for them, or larger species associated with a particular habitat, such as gorgonians or sponges. The handsome colors of *Ophiomyxa flaccida* and the bright rusty-red lower surface of *Ophiocoma riisei*

make those species attractive objects, even to a person who is not a zoologist, but the other Bermudan brittle-stars are not conspicuous animals.

1. Ophiomyxa flaccida (Say)

This smooth, bright-colored, large and active brittle-star is found more or less frequently under rocks at or below low water mark near the Causeway, Long Bird Island and Coney Island. It was not found at Hungry Bay, and is not yet recorded from the southern or western shores of Bermuda. It is a typical West Indian species ranging from Bermuda to Brazil.

2. Asteroporpa annulata Lütken

Verrill (1901) records (under the name *Astroporpa affinis* Lütken) 4 specimens of this small-bodied, long-armed ophiuran from "a large gorgonian (*Verrucella grandis* Verrill) brought up from about 100 feet, off the outer reefs, on a fisherman's hook". It probably occurs wherever this gorgonian (now *Scirpearia grandis* (Verrill)) or similar forms are growing, and it may occasionally be washed up on a beach, but it is unlikely that it occurs normally in less than 10 fms. of water and hence it is not included among the strictly littoral echinoderms of the West Indian region.

3. Amphipholis gracillima (Stimpson)

Verrill (1900) reports this long-armed, small-bodied amphiurid, under the name "*Amphipholis goesi* Ljung.", as having been dredged in 20–30 ft. of water in Baileys Bay in 1898. The species is known from Charleston, S. C., through the West Indian region to Rio de Janeiro, Brazil, but I have seen no specimens from Bermuda. At Sandy Point, Buccoo Bay, Tobago, it is quite common, buried deeply in the sand, just below low-water mark.

4. Amphipholis squamata (Delle Chiaje)

This almost cosmopolitan amphiurid is common in Bermuda, but owing to its small size (usually less than 4 mm. across the disk) and secretive habits (hidden in shells or rock crannies) it is very easily overlooked. Verrill (1900) lists it under the name *Amphipholis tenera* (Ltk.) Ljung.

5. Ophiostigma isacanthum (Say)

This small West Indian brittle-star seems to be very rare in Bermuda. Apparently neither Verrill nor the New York University parties ever met with it, nor have I. The Heilprin party (1888) took "two very young specimens, dredged in Harrington Sound". In July 1917, Dr. W. J. Crozier took 2 specimens in Fairyland Creek, a large bay in the western coast of Pembroke; these specimens are now in the M. C. Z. collection: one is a normal but rather small 5-armed adult, 3 mm. across the disk; the other is a 6-armed specimen little more than 2 mm. across the disk with 3 arms of one side smaller than the opposite 3, indicative of reproduction by schizogenesis.

6. Amphiodia repens (Lyman)

This is another small amphiurid, which is probably fairly common, but is seldom noted, owing to its small size and secretive habits. It is rarely as much as 4 mm. across the disk, but the slender arms may be 8 times as much. The disk is light gray but the arms are white in rather marked contrast: frequently, however, there are gray markings on the arms and especially on the surface of many of the arm-spines; these dark spots on some or many arm-spines may be on either the upper or under surface or on both. This brittle-star lives more or less buried in undisturbed sand, usually where some eel-grass or similar vegetation is growing, and may be discovered by sifting such sand through a sieve. In the cove at Coney Island where *Eupatinapta acanthia* is found, *repens* is frequently met with.

7. Ophiactis algicola H. L. C.

This is still another secretive little brittle-star, but its habits are quite unlike the preceding. It lives among coralline algae, bryozoa, etc. on rock fragments and never buried in sand. The arms are relatively short and like the disk are variegated with light and dark shades of gray and brown. The only specimen as yet known from Bermuda was taken June 24, 1916, at "Brackish Pond Flat", by Dr. W. J. Crozier, and is now in the M. C. Z. collection.

8. Ophiactis savignyi (Müller and Troschel)

This very common tropicopolitan species may be found almost anywhere in the shallow waters of Bermuda living "in the interstices of

sponges and corals, often gregariously while young" (Verrill, 1900, p. 586, under the name *Ophiactis Krebsii* Lütken). Adults are rare, nearly all specimens taken having 6 arms, and the disk less than 5 mm. across.

9. Ophiothrix angulata (Say)

Verrill (1900, p. 585) says this species is "not common" but he gives no single record of its occurrence in the Bermudas. It does occur at Challenger Bank, but its presence in the Bermuda group itself needs confirmation.

10. Ophiothrix suensonii Lütken

Verrill (1900, p. 585) includes this species as a Bermudan brittle-star but rests its claim on the statement that it was "collected at Bermuda by Mr. G. Brown Goode". Its occurrence at the Challenger Bank is well attested, and it is quite probable that it lives among the Gorgonians of the deeper waters of Bermuda itself.

11. Ophionereis reticulata (Say)

This is probably the commonest Bermudan brittle-star, as it occurs wherever rock fragments rest on clean sandy bottoms. Large specimens often show a reddish tinge and in some cases the net-work of lines on the disk is quite orange-red. These brighter shades disappear, as a rule, in preserved material.

12. Ophiocoma echinata (Lamarck)

Common under rocks near low water mark on sandy bottoms. Reaches a large size (30 mm. across disk) at Gravelly Bay and Hungry Bay on the south shore.

13. Ophiocoma pumila Lütken

Common but much more secretive than the preceding species. Adults manage to conceal themselves among algae or in crannies in rocks and corals where their dull-brown color helps to hide them. The 6-armed, green and white young are more conspicuous and much more easily found; their resemblance to *Ophiactis savignyi* is great enough to make confusion between the two species easy.

14. Ophiocoma riisei Lütken

Common at all suitable localities, such as Gravelly Bay and Hungry Bay, where it reaches maximum size (disk, 30–35 mm. in diameter, in life). The rusty-red color of the oral surface is very striking, and as it is constant, it makes a convenient "recognition mark" in the field. Unfortunately it is less obvious in preserved material.

Note: Verrill (1900, p. 586) reports *Ophiopsila riisei* Lütken from Bermuda, giving Lyman as his authority. There is some mistake about this, for there are no Ophiopsilas from Bermuda in the M. C. Z., and it is quite unlikely that Lyman ever had any specimens from there. It is possible that Lyman may have written "Bermuda" at some time when he intended to have written "Bahamas," but this is merely a guess. Verrill's later listing (1907, p. 284–328) is not substantiated by any definite evidence.

15. Ophioderma appressum (Say)

Fairly common on sandy bottom near low water mark, usually under rocks.

16. Ophioderma brevicaudum Lütken

Reported only by Verrill (1903, p. 584) who says it was "not common" in 1898. I have never seen a Bermudan specimen. In 1907 (p. 282 (= 326)) Verrill also lists *Ophioderma brevispinum* (Say), but gives no authority for its occurrence in Bermuda. I have never seen or heard of a Bermudan specimen.

17. Ophioderma cinereum Müller and Troschel

This is one of the larger West Indian species, reaching a disk diameter of 30–35 mm. in Tobago where it is very common. Verrill says it was taken in Bermuda by the Yale party in 1898, but as he says it occurs in "interstices and crevices of the reefs," I am dubious as to the identification of his material. In Jamaica and Tobago, it occurs only under slabs of broken coral and rock, and makes no attempt to get into interstices and crevices. Its large size and rather rigid arms are quite out of keeping with hiding in crevices!

18. Ophiolepis paucispina Müller and Troschel

This little brittle-star proves to be fairly common, after one has learned where and how to find it. It lives on or in the sand under rock

fragments, and when such a fragment is turned over, it seems to be sucked up and forced to lie with its aboral surface against the lower side of the rock. As the lower surface is white or cream-color and the arms are coiled close to its margin, the brittle-star becomes rather difficult to detect. At Hungry Bay, Ophiolepis is quite common, but it does not seem to be so numerous along the north coast, though we took specimens at the cove on Coney Island in 1939.

ECHINOIDEA

Echini, sea-urchins, key-hole urchins, heart-urchins, etc.

Of the 12 Bermudan echini, only one, *Lytechinus variegatus atlanticus*, can be considered really common. In particular localities, Centrechinus, Tripneustes and Echinometra, can be secured in considerable numbers, under favorable conditions, and *Leodia sexiesperforata* is apparently fairly common on those pure sandy bottoms which it favors. The remaining half dozen species are distinctly rare or restricted to such inaccessible areas that they are rarely taken. Of two or three of these, living specimens have not yet been secured.

1. Eucidaris tribuloides (Lamarck).

Not very common, but occurs at North Rock, Coopers Island, and other similar reef areas.

2. Centrechinus antillarum (Philippi)

Fairly common on the outer reefs and on rough, rocky shores, as at Coopers Island, Hungry Bay, etc. Listed by Verrill as "*Diadema setosum*".

3. Lytechinus variegatus atlanticus (A. Ag.)

Very common on sandy or "grassy" bottoms. Young ones are also to be found under or among rocks. Often the rich dark red-violet color is not acquired until the urchin is half-grown, young ones being greenish, with more or less white and even with pinkish tips to the primary spines, as in Florida specimens.

4. TRIPNEUSTES ESCULENTUS (Leske)

Fairly common and reaching a large size, up to 150 mm. in diameter, the maximum for the species. Young ones are found under and among rocks but the adults occur out on the open bottom. Apparently there is an absence of enemies and conditions favor growth.

5. ECHINOMETRA LUCUNTER (Linn.)

Very common on suitable rocky areas, and conditions apparently favor growth, as in the case of Tripneustes, for the largest known specimens (85–90 mm. in the greater diameter) were found in Bermuda.

6. CLYPEASTER ROSACEUS (Linn.)

This species has not hitherto been recorded from Bermuda, but there are bare tests in the Museum at the Aquarium which I was assured were taken locally. Unfortunately there are no data with the specimens. Similar bare tests were seen at a curio store in St. George but it is possible they came from further south.

7. CLYPEASTER SUBDEPRESSUS (Gray)

This species, like the preceding, has hitherto been unrecorded from Bermuda, but there is at least one bare test in the Museum at the Aquarium which I was assured was taken in Bermuda. The absence of definite data is greatly to be regretted.

8. MELLITA QUINQUIESPERFORATA (Leske)

Verrill (1907, pp. 144 and 188) lists this species (under the name *testudinata*) as having been recorded by R. J. Nelson in 1840 as a fossil occurring on "Ireland Island and the islands in Crow Lane, Hamilton". He adds: "It has not been observed here by others, either living or fossil". It is therefore a matter of very great interest that there is a specimen at the Bermuda Biological Station which Dr. Wheeler assures me was dredged in the vicinity of St. Georges, or at least in the northeastern waters of Bermuda. This specimen is bleached to a pure white and is fragile. It is 82 mm. long by 84 mm. wide, but as the posterior margin of the test is concave, the full length may be

reckoned as 84 mm. The form is rounded pentagonal with all the angles rounded and all the sides concave, the posterior margin most markedly so. The posterior petals (I and V) are 14–15 mm. long and 6 mm. wide while the anterior (II and IV) are 13–14 mm. long and 5.5 mm. wide; unpaired petal (III) is 16 × 6 mm. All the petals are narrowly open. The posterior lunules (I and V) are 14 mm. long; V is about 1.5 mm. wide, but I is aberrant and somewhat deformed, 2 mm. wide at the proximal end and 5 mm. wide distally. Anterior lunules II and IV are 11 by 1 mm. and the posterior interradial lunule is 12 by 2. Owing to the way in which the specimen is mounted for exhibition, the oral surface could not be examined.

In all of the more than 800 specimens of this Mellita in the M. C. Z. as well as among the scores I have examined elsewhere, I have never seen a specimen with the sides so markedly concave as in this individual from Bermuda. Another remarkable feature is seen in the small petaloid area; in a typical specimen from Florida, 80 × 83 mm. the petaloid area is about 50 mm. long by 45 wide, but in this Bermudan specimen, of practically the same size it is hardly more than 35 by 32. In the Florida specimen, petal III is 21 mm. long, in the Bermudan it is but 16, and the other petals are proportionate. A third notable character of the Bermudan Mellita is the small size of the unpaired lunule which is only 12 mm. long while the posterior paired lunules are 14. In the specimen from Florida, the posterior paired lunules are also 14 mm. but the unpaired lunule is 19 mm.

In view of these striking differences it is probable that the Bermudan Mellita is a local species distinct from *quinquiesperforata*, or at least a well-marked variety. But until more material is available and we have some idea of the extent of individual diversity in the Bermudan form, it is hardly wise to designate it by a new name.

9. Leodia sexiesperforata (Leske)

The revival of Gray's (1851) generic name for the key-hole urchins with 6 lunules, which Lambert and Thiery proposed in 1921, seems quite justified since we now know that the lunules originate in a very different manner from that found in Mellita. In Leodia they arise by resorption, in Mellita by the closing distally of marginal notches, a most extraordinary difference.

Leodia appears to be common at suitable places in Bermuda but exact localities have not been recorded. Dr. H. B. Moore took us, April 18, 1939, on an excursion to West Whale Bay, on the west coast

of Southampton parish, where there is a wide area of shoal water with a clean sand bottom in which Leodia seems to thrive. Of the specimens we secured, two were exceptionally large and one, taken by Clark G. Myers, proved to be the largest representative of the species yet recorded, as it measured 117 by 125 mm. In life Leodia is a pale fawn color but this becomes a deep green in killing agents of any sort, even fresh water. If, however, specimens are dried very thoroughly, directly from the sea-water, the salt can later be soaked out of them without, as a rule, affecting the color.

10. Echinoneus cyclostomus Leske

This sluggish tropicopolitan echinoid was long since recorded from Bermuda, but very few specimens have been taken. A. H. Verrill took two from sand under rocks, at very low tide in Hungry Bay in March, 1901, but diligent search by the writer during three visits to Hungry Bay in 1939, failed to disclose a single specimen. At the Bermuda Biological Station, there is a fine bare test of large size (37 × 30 mm.) which was found at Coopers Island.

11. Moira atropos (Lamarck)

This unmistakable spatangoid, well known from the southeastern coast of the United States and the northern West Indies, has never been taken in Bermuda, except for the two semi-fossil specimens dredged in Castle Harbor, referred to on p. 368. These are of maximum size (60 mm. long) and heavily covered with deposited lime. Whether Moira is now extinct in Bermuda or still lives in suitable localities remains to be determined.

12. Brissus brissus (Leske)

This spatangoid, common to the Mediterranean and the West Indies, seems to be rare at Bermuda, but there are specimens in the Museum at the Aquarium which I was assured were Bermudan. In the West Indies, Brissus is usually small (50–70 mm. in length) but in the eastern Atlantic and Mediterranean it is nearly twice as large (115–135 mm.). The specimens at the Aquarium were larger than any Jamaican specimens I have seen. Like Echinoneus, with which it is frequently associated, Brissus lives buried in sand under rocks, and its natural color is very similar to that of the sand.

HOLOTHURIOIDEA

Holothurians, sea-cucumbers, synaptids, etc.

Of the 13 species of holothurians, the big Stichopus is easily most abundant, and is moreover one of the commonest and most conspicuous of the marine invertebrates of Bermuda. Almost equally common but so much smaller and more secretive, that it is seldom noted by the average person, is *Chiridota rotifera*, found in the sand under rocks along shore wherever conditions are not unsuitable. Of 2 species (*Actinopyga agassizii*, *Holothuria impatiens*) only a single specimen of each has been taken as yet, and oddly enough both were found at the entrance to Hungry Bay. They are common West Indian forms and will probably be found ultimately in Bermuda in reasonable numbers. It is not impossible however that these two species have arrived from the south as larvae or very young individuals on ship bottoms, and are not yet fully established. Of the 5 species of Holothuria, 2 (*parvula* and *surinamensis*) are common and may be found on the under side of rock fragments near low watermark, wherever the water is clean and well aerated. Another species, *arenicola*, is common, at least on the south coast, deeply buried in sand under rock-fragments, but is easily overlooked. In a similar habitat occurs a fourth species (*cubana*) which seems to be rare. There are only 2 dendrochirote species; one, a Thyone, seems to be common in some seasons or localities and rare at others; the second, a psolid, has only just been discovered at Hungry Bay, where it is not very rare but is hard to detect. There are 3 species of worm-like synaptids which are more or less common, but they are so concealed by either their coloring or their habits that they are seldom noted save by the collector who knows where to locate them.

1. Holothuria cubana Ludwig

This small whitish holothurian lives buried in sand close to or under rock-fragments. It is very sluggish and secretive. The body wall is firm and rather rough, in part from sand grains which adhere tightly to it. We found a single specimen in April, 1939, near the "Causeway", on the Ferry Reach side.

2. Holothuria arenicola Semper

This tropicopolitan species is common on the southern coast of Bermuda, particularly at Gravelly Bay and Hungry Bay. It grows to

a large size (250–300 mm. long), but always lives deeply buried in the muddy sand under rock-fragments. Owing to its dull sandy, or often rusty, color it is easily overlooked. There are always spots or blotches of dusky gray or dull purplish, but these show great diversity in number, size and distribution.

3. Holothuria impatiens (Förskål)

A very fine and typical representative of this tropicopolitan species was found under a rock near low water mark at Hungry Bay, April 24, 1939. Its characteristic extrusion of copious Cuvier's organs was notable. Apparently this is the first record of *impatiens* in Bermuda.

4. Holothuria parvula (Selenka)

This is a very common and generally distributed small holothurian, usually under 60 mm. in length and rarely, if ever, exceeding 75 mm. The bright or deep brown color, flattened ventral surface and copious Cuvier's organs, make its recognition easy. It occurs always on the under surface of rock fragments in shallow water, and there are frequently several on a single piece of rock — sometimes there are 10–12. In all previous Bermudan lists, this species has been called *H. captiva* but *parvula* is the earlier name.

5. Holothuria surinamensis Ludwig

This is also a very common holothurian on the lower surface of rock-fragments in shallow water. It is usually about 100 mm. long but large individuals are notably extensile and may stretch to about twice that length. It is often found with *parvula*, but is readily distinguished from that species by its more cylindrical form, whitish or light yellowish tentacles and absence of Cuvier's organs. The color ranges from a reddish-brown to a dull purplish-gray, with or without more or less blotching with a different shade. Some of the large gray specimens are superficially quite like *impatiens* but are readily distinguished by the pedicels and the absence of Cuvier's organs.

6. Actinopyga agassizii (Selenka)

There is a single record of this species from Bermuda (W. J. Crozier, 1917, Ann. Mag. Nat. Hist. (8) **19**, p. 405) but unfortunately the specimen was not preserved. It was an adult, about 250 mm. long, taken

in some 6 feet of water at the entrance to Hungry Bay. Further collecting by various individuals, at Hungry Bay and elsewhere, has failed to produce another representative of the genus. There is no apparent reason why the species should not be a permanent member of the Bermudan fauna.

7. Stichopus badionotus Selenka

This common West Indian holothurian is one of the most obvious and widely distributed of the Bermudan echinoderms. It seems to be present almost everywhere that the water is clear and well aerated. Unlike the *badionotus* of Jamaica, the Bermudan Stichopus is remarkably constant, in coloration, but in two forms. The great majority of individuals are unicolor and commonly so dark they appear to be black. Close examination in good light shows that the lower surface is lighter than the upper, and the real color is a very deep purple or blackish-brown. In some cases the color is definitely brown or even yellowish-brown, but these lighter shades are not common. The other form is a light wood-brown, orange-brown or orange-buff, more or less blotched and spotted with black or black-brown. This maculated form looks so different from its unicolored congener, that Heilprin (1888) regarded them as distinct species, each of which he thought was undescribed. The unicolored one he called *diaboli* and the spotted one, *xanthomela*. These words may be conveniently used as varietal or "form" names for Bermudan material, but in Jamaica no such distinction is possible, as spotted and unicolor forms mingle in inextricable confusion. It has been suggested that the spotted individuals in Bermuda are the young, the more heavily pigmented, unicolored ones being adults. One fact in support of this idea is that small individuals, under 100 mm. in length, and living on the lower surface of rock-fragments, have but little pigment. In life they are translucent, light buff with only the low, rounded, conspicuous papillae capped abruptly with black-brown. It is easy to assume that with increasing size and maturity, the deposits of pigment would become heavier and heavier until the animal was fully pigmented. In certain individuals however the unicolored condition is never attained — just why, it is hard to even guess, but large specimens of *xanthomela* are by no means very rare. The largest specimen of *badionotus* I have ever measured, and I believe it is the largest I have ever seen, was a true *xanthomela*, orange-buff, heavily mottled and spotted with black. It was taken April 21, 1939, while dredging in only 2 or 3 fms. of water in Ferry

Reach, and measured, in the Aquarium some hours later, more than 500 mm. long, 110–120 mm. wide and 75–80 mm. high. But complete pigmentation may be attained apparently early in life, for "black" individuals may be found less than 200 mm. long. The whole matter of pigmentation in echinoderms needs and deserves careful and exhaustive study, for it is at the present time a virtually untouched field. Research by either the physiological chemist or the biologist or both will certainly yield far-reaching and important results.

8. Thyone surinamensis Semper

This species was first recorded from Bermuda by Heilprin in 1888 as *Semperia bermudensis* sp. but ten years later, I suggested this name was a synonym of *Cucumaria punctata* Ludwig, and in 1901, I stated that the species was "not abundant" in Bermuda. In 1907, Verrill called it "the most common reef species" of holothurian. In 1926, Dr. Deichmann reported (on the strength of material from Barbados) that Ludwig's species was identical with Semper's *Thyone surinamensis* of 1868, and in 1930 she reported it as "abundant at Bermuda", a statement which I modified in 1933 to "very common". In 1939, however, I failed to find a single specimen in more than two weeks of diligent collecting. It is obvious therefore that it is not now "abundant", except possibly in certain areas which I did not visit.

9. Thyonepsolus braziliensis (Théel)

The discovery of a Psolus-like holothurian on the under side of rock-fragments at Hungry Bay, April 22, 1937, was the most interesting incident of the month's Echinoderm-collecting. The two specimens taken measured 13 × 6 × 3 mm. and 23 × 12 × 6. They were not found together, but each was living closely appressed to the lower surface of a rock-fragment, sufficiently large not to be disturbed by ordinary currents or waves. The rocks were so near low-water mark, it is probable they were never quite out of water. The animals were deep rosy red (with a purplish tinge), slightly variegated with light gray, while the lower surface was light yellowish with but very little pigment. Considerable pigment has dissolved in the alcohol in which the animals are preserved but the deep rosy color is still very obvious. The resemblance in coloration to an encrusting bryozoan which occurred abundantly in small, roughly circular patches, less than 25 mm. across, on the lower surface of the rocks near low tide level, was

so exact that only touching the holothurian could assure the collector that it was not a patch of bryozoa. On Monday, April 24, further search at the same place resulted in the taking of six more specimens, which ranged in size from 10 × 5 × 3 mm. to 18 × 8 × 4. Preservation in alcohol results in a shrinkage of 20% or more in length and width, but alters the height very little. The coloration is alike in all the specimens, and has changed but little in alcohol; the larger specimens have the rose-color deeper and more tinged with purple than in the small specimens.

Comparison of this material with that in the M. C. Z. from Brazil and Tobago, which is labelled *Th. braziliensis*, leaves some room for doubt as to the identity of the Bermudan specimens. For the older material has lost all trace of rose-color, if it were ever present, and is simply dirty whitish. There is no hint as to what the color in life of the Brazilian form may have been, but the Tobagoan specimens, which are all much smaller than those from Bermuda, were collected by me in April, 1916, and are recorded in my note-book as "old rose" in color. Doubt as to the identity of the Bermudan form is not due so much to its notable coloration as to the fact that it has so thick a skin over the dorsal scales as to conceal them quite completely while in the Brazilian and Tobagoan specimens the scales are very distinct, with only a thin skin over them. It is quite possible, therefore, that sufficient material will demonstrate that the Bermudan Thyonepsolus is a distinct species. Its generic position is clearly indicated by the numerous appendages all over the dorsal surface.

10. Synaptula hydriformis (Lesueur)

The occurrence of this synaptid in Bermuda in two quite different forms has long been known. Verrill considered these forms as distinct species. The larger, more striking green and white form he called *Synapta viridis*, while the more or less striped or variegated brown form he called *Synapta vivipara*. There is no evidence that he ever critically compared the two and without such a comparison it is hard to believe they are identical. The green and white form is found among green zoanthids and algae on the margins of rock fragments or on the open sea-bottom. When among zoanthids, it may be relatively short and stout, with disproportionately long tentacles (35–50 mm. long, 5 or 6 mm. in diameter, the tentacles 10 mm. long) while among algae it is more slender and the tentacles are shorter. In both cases, the green and white (or pale gray) variegation is certainly notably concealing,

so far as human eyes are concerned. The brown and light gray or whitish (variegated or more rarely striped) form lives among brown algae and similar growths among rocks or on mangrove roots (or branches which are under water at their tips). Both forms are viviparous and agree in all structural details.

Dr. Wheeler called my attention to the fact that the dull-colored form occurred in a small land-locked body of water on St. George Island known as Lovers Lake. This seemed incredible, but he went to the lake and brought back specimens, and a visit by Dr. Moore and myself subsequently yielded many individuals, of all sizes, from the aquatic growth on the mangroves with which the lake is surrounded. While there can be no doubt that this lake has subterranean connection with the sea, the water is distinctly less saline than that of the ocean. The seawater around Bermuda has a salinity of 36.4 while that of the lake, kindly analyzed by Dr. E. F. Thompson, was only a trifle over 35. The only tangible evidence that this lessened salinity has affected the synaptids is that in the larger specimens the anchor plates in the bodywall show a tendency to deformation and many are asymmetrical. In some specimens, many, perhaps most, of the plates are abnormal but other equally mature specimens have the plates very generally normal. Apparently the difference from the individuals living in normal sea-water has not yet become a distinguishing mark of the Lovers Lake specimens. As the latter are now a practically isolated colony it will be interesting to note whether, with the passage of time, they develop any distinguishing morphological features.

Both the green and the brown Bermudan Synaptulas differ in general appearance in life from the Jamaican form as much as they do from each other, but I cannot find any tangible characters by which the three forms can be distinguished from each other when killed and preserved.

11. Eupatinapta acanthia (H. L. Clark)

This interesting and apparently endemic species was again found in April, 1939, in the cove on Coney Island where it was originally taken but it was not secured at any other place. There seems to be little ground for doubt that the tiny synaptid, only 16 mm. long, which I identified in 1899 as *inhaerens*, was merely a very young example of *acanthia*. At that size, it is probable that two species are not certainly distinguishable.

In spite of the building of the railroad, and other local changes in

the immediate vicinity, the little cove on the northwestern side of Coney Island is very much as it was forty years ago, and it was a pleasant experience to again collect this fine synaptid at the exact spot where I dug it in 1899. Probably it will be found elsewhere, at least in Bermuda, under similar ecological conditions, but it is rather odd that no other definite locality is known. Heding (1928) records 40 specimens taken by Mortensen, July 14, 1926, but gives the locality merely as "Bermuda: sandy shore at low water". It would be interesting to know where this particular sandy shore is.

12. Epitomapta roseola (Verrill)

This species was surprisingly uncommon in April, 1939, and all of the few specimens taken were very small. Hence I am unable to throw any further light on its distribution and habits, or on Heding's variety *alba*, of which Mortensen secured 27 specimens in 1926. Further study of this synaptid both at Bermuda and elsewhere is much to be desired.

13. Chiridota rotifera (Pourtalès)

Apparently as common and widely distributed as it was forty years ago, this little holothurian was found plentifully at Achilles Bay, Gravelly Bay, Long Bird Island and Hungry Bay. We did not find it at the cove on Coney Island, which seems a little odd.

SUPPLEMENTARY NOTE

In addition to the above 48 species, it may be convenient to mention here the 5 additional species which are known to occur on the Challenger Bank, only about ten miles southwest of Bermuda, in water some 30 fms. deep. It is noteworthy that 4 of the 5 species are sea-stars. They are as follows:

Chaetaster nodosus Perrier

Aside from its occurrence at Challenger Bank, where it seems to be fairly common, as both the "Challenger" (1873) and the "Gladisfen" (1903) secured a number of specimens, this sea-star is known only from Guadeloupe, depth unknown, 1 specimen, and from off Havana, Cuba, 140–200 fms.

Ophidiaster schismochilus H. L. C.

The holotype alone is known of this notable sea-star. It was taken by the "Gladisfen", August 1, 1903, in 30.5 fms. on Challenger Bank.

Stephanasterias gracilis (Perrier)

The occurrence of this West Indian sea-star on Challenger Bank in about 30 fms. is most interesting, for it is otherwise known only from numerous West Indian stations in 56–270 fms. The "Gladisfen" took 4 specimens in 1903.

Coronaster briareus (Verrill)

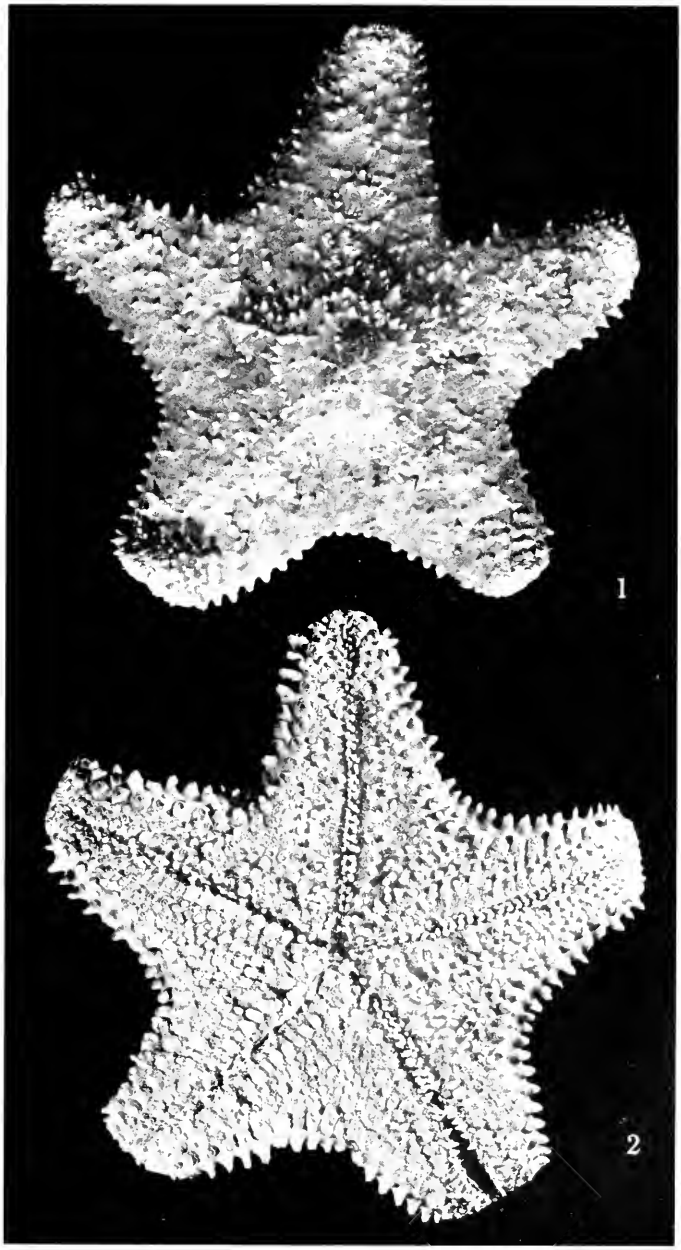
The "Gladisfen" took a single specimen of this multirayed sea-star but there are no data with it. It is a deep-water species of the western Atlantic.

Stylocidaris affinis (Philippi)

This sea-urchin is common in the Mediterranean and in the West Indies in moderately deep water. Its occurrence at Challenger Bank, where the "Gladisfen" took one specimen, is not strange therefore, and it will not be surprising if more dredging around Bermuda itself reveals it as a resident there.

EXPLANATION OF PLATE

Oreaster reticulatus var. bermudensis
Fig. 1. Upper surface
Fig. 2. Lower surface
About one-fourth natural size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NOTES ON THE UNITED STATES SPECIES OF TACHYTES

(*Hymenoptera: Larridae*)

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WITH TWO PLATES

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No. 9. — *Notes on the United States species of Tachytes (Hymenoptera: Larridae)*

By Nathan Banks

In 1892 Fox published a revision of this genus and later, 1893, added one new species. His division of the males according to the structure of the front coxae and front femora is most useful, but the separation of the females as "bee-like" or not, is not so helpful. Since then Rohwer has described about ten species, Viereck and Mickel three, Bradley and I one each. For some years I have tried, at intervals, to prepare better tables for the females, and to include some of those later described, and some which appear to be new.

Patton, whose descriptions are extremely good, noted that *mandibularis* had more spines on the front basitarsi than some other forms. This has been used abroad in synoptic tables. However the extra spine is sometimes shorter or absent, but is helpful at times.

On the upper edge of the hind and usually mid basitarsi are usually two spines before the tip of the joint, in several species there are three of these spines, and they are usually broader, and somewhat curved; I have utilized these, and also made a table for those having this character, although they are somewhat variable.

Fox noted that in *aurulentus* the legs were bare; many species have the femora hairy on sides and beneath; however, there are a number of species in which the hind femora have no (or only a few) erect hairs beneath. This appears to be a fairly natural character. Rohwer (Ent. News, **20**, 197, 1909) arranged the females in three sections according to the color of the scales on the pygidium. The bronzy (often partly black) ones are readily distinguished; those with golden or whitish scales are not so readily separated, for some of those with golden in one view may appear partly whitish in another view, and some considered white may show some yellowish. However, the grouping is helpful and I have made tables to each group.

The males will doubtless be more surely distinguished by a study of the male genitalia. I have figured some of these. I have given tables to one section of the large males, and to the small forms, in order to include species described since Fox. The shape of the last ventrite (8th) in the male is often very useful in separating closely allied species; in the small forms it shows less difference. The distance apart of the lateral points of this ventrite, and the amount of excision varies somewhat, and when these points are lobes, as in *calcaratus*, the breadth of the lobe may vary a little.

The comparative length of the third and fourth antennal joints, although fairly constant, is often about the same in allied species. Likewise the comparison of vertex-width with the length of second plus third antennal joints is sometimes not satisfactory, for when the third joint is longer the vertex may be broader.

The approach of the recurrent veins toward each other, noted in species with a partly red abdomen is also variable; likewise the width of the second and third submarginal cells on the radius is also variable. In some species the third submarginal cell is very long, but it is more of a group character. In some of the small species there is a triangular, usually polished, depression above the ocellar region, but it is not definite enough in all cases to be useful. I have noted that the hind basitarsus in some species has one or more spines on the anterior (outer) side, while in others there is none except at the tip, and in these forms the basitarsus is slightly concave on outer side; this character may prove to be more important with further studies.

In those with hairy hind femora and in some others the groove on the posterior slope of the propodeum is widened near middle and above; in most of the small forms it is not or scarcely widened, but in some of these (*parvus*, *pattoni*) it is widened in the male. In some the groove plainly reaches the end of the propodeum.

Turner has used the length of the galea compared with length of the scape. In most museum specimens the galea is not extended, but in a number that I have seen there does not appear to be much variation in our species, many are shorter than the scape, a few as long or a little longer. A more useful structure is the tongue (or labium) and the size and extent of its lobes; I have figured these for several species.

The sculpture in closely related species is but little different, and not easily described; the second ventral in our species is dull and densely and finely punctate, except on the hind border. Here there is a curved row of long bristles, usually four on each side, at least one (*crassus*) showing five or six. In one (*aurulentus*) the fourth from center is more removed from the others than usual. Various other minor structures could, doubtless, be studied with profit.

I have examined the types in Philadelphia and Washington, and the M. C. Z. possesses paratypes of some of Cresson's and Rohwer's species. Several changes have been made in names as will be explained under each species.

I have proposed a new genus for *Tachytes mergus* and an allied new species. The species which have a distinct line or groove on the dorsum of the propodeum are evidently closely related, and could form a sub-

genus, if the character were constant; some specimens of *T. harpax* and *T. columbiae* show it, in others faint or absent.

I have placed *Tachytes mergus* Fox and a related new species in a new genus, Tachyoides, which can be distinguished as follows:

Basil joint of antennae of female very long, fusiform, more than one-half of basal width of face; pygidium with but few scales, so that the ground color shows between the scales; male similar to Tachynana, except somewhat narrower vertex (cf. p. 409) ..... *Tachyoides*

Basal joint of antennae shorter in both sexes, not fusiform, not one-half basal width of face; pygidium covered with scales ..... *Tachytes*

The type of Tachytes is *T. tricolor* Panzer (*T. europaea* Kohl). The hind femora are bare, two spines on the hind basitarsus above, base of abdomen rufous, and it is very similar to the species I have described as *T. cressoni*. Dahlbom made a genus Tachyptera for *T. obsoleta* Rossi and other European species. This is a black-bodied species, four silvery bands, two spines on hind basitarsus, hairy hind femora, and a faint groove above on propodeum and thus is very similar to our *T. mandibularis*. The name Tachyptera is preoccupied, and since those with the hairy hind femora are easily separated I propose a new subgeneric name (Tachyplena) for this section, and another (Tachynana) for the small species.

I desire to thank Dr. F. E. Lutz and Dr. H. Schwarz of the American Museum for loaning material; Prof. C. T. Brues for specimens from his private collection, and Dr. C. S. Brimley for the opportunity to examine specimens from his collection.

The best grouping of the females that I can suggest now is the following:

1. Hind femora plainly with pendent hairs along most of its lower edge; median groove on posterior slope of propodeum broadened above; but two spines above on upper edge of hind basitarsus before tip, and with one or more spines near middle of outer (anterior) side; pleura and sternum with long hair. Subgenus *Tachyplena* **subgen. nov.** genotype *T. mandibularis* Patton. Other species included are *validus, praedator, belfragei, calcaratus, calcaratiformis, harpax, columbiae, crassus, distinctus, badius, foxi, auricomanes, ermineus, floridanus,* and

comanche; the last six may form a separate group; they have four spines on front basitarsus (others five), the tibiae are black (in others rufous), and the hind basitarsus sometimes has three spines above.

In all species the males have no groove on base of front femora, and no projection at tip of front coxae.

1a. Hind femora practically without pendent hair beneath, except possibly a little near base 2

2. Median groove on posterior slope of propodeum not or scarcely widened near middle or above; hind basitarsus with one or two spines near middle of anterior (or outer) side, and with one or two spines above before tip, rarely three; third joint of antennae often no longer, frequently shorter than the fourth joint; hind tibiae with the spines above usually short and often stubby; mostly small species. Subgenus Tachynana **subgenus nov,** type *Tachytes obscurus* Cresson; includes also *abdominalis, obductus, birkmanni, pattoni, maestus, arizonicus, parvus, atomus,* and several species known only from males, *minor, minutus, intermedius, hirsutifrons,* and *amiculus,* and probably *austerus.*

2a. Median groove on posterior slope of propodeum widened near middle and above; third joint of antennae as long or longer than fourth, and usually twice as long as second; spines of hind tibiae above sharp, not stubby; frequently three spines above on hind basitarsus before tip, and in several species no spines near middle of front side of basitarsus; large species. Subgenus Tachytes, type, the European *T. tricolor;* contains *aurulentus, austrinus, exornatus, rufofasciatus, elongatus, cressoni, fulriventris, utahensis, hesperus, brevipilis, pepticus, sayi,* and *sericatus.*

Females of subgenus Tachyplena

1. Tibiae rufous; five spines on front basitarsus, two on hind basitarsus; median line on propodeum above usually distinct 2
Tibiae black; four spines on front basitarsus; often three on hind basitarsus 12

2. But three silvery bands on abdomen; the pygidium bronzy 3
With four silvery bands on abdomen; wings yellowish 4

3. Bands on abdomen often faint except on sides; mesonotum bordered with gray pubescence; face rather dull golden; fourth and usually third tarsal joints without spines ..... *crassus*
Bands on abdomen distinct; mesonotum bordered with golden, face bright golden; third and usually fourth tarsal joints with spines ..... *distinctus*

4. Pygidium bronzy to black; face golden; thorax with more or less golden pubescence ..... *mandibularis*
Pygidium golden to whitish 5

5. Pygidium whitish or silvery 6
Pygidium golden to yellowish 7

6. Silvery bands bend forward near middle of each segment; face more silvery; southern ..... *belfragei*
Silvery bands follow margin of segments; northern *calcaratiformis*

7. Propodeum densely clothed with golden pubescence, also on pleura, and sides of mesonotum, and fully as bright on face; femora hardly more than one-half black; bands on abdomen often somewhat yellowish ..... *praedator*
Not so much golden on propodeum, and if face somewhat golden the femora black to near tip 8

8. Face silvery white seen from in front; third joint of antennae plainly longer than fourth 9
Face more or less golden to yellowish 10

9. Pygidium golden ..... *calcaratus*
Pygidium whitish ..... *calcaratiformis*

10. Body broad, pygidium broad, bright golden; third antennal joint plainly longer than fourth; last joint of antennae tapering and longer than penultimate ..... *validus*
Body and pygidium more slender; pygidium not so bright golden; third joint of antennae but little if any longer than the fourth 11

11. Hind tibia with a distinct dark streak on inner side; clypeal margin with a distinct median narrow somewhat bilobed projection; third joint of antennae a little longer than fourth *harpax*
Hind tibia without distinct dark streak; clypeal margin with a broad but low projection; third joint of antennae scarcely longer than fourth ..... *columbiae*

12. Pygidium coppery to black; body with but little silvery pubescence; third antennal joint hardly longer than the fourth ..... *badius*
Pygidium whitish or golden 13

13. Pygidium whitish to yellowish; body and legs somewhat silvery pubescent; third antennal joint hardly longer than fourth; last tarsal joint pale ..... *foxi*
Pygidium yellowish to golden; body and legs strongly silvery; third antennal joint longer than fourth; last tarsal joint dark ..... *ermineus*

Females of subgenus Tachytes

1. Wings very dark; but two silvery bands on abdomen; pygidium bronzy to black ..... *aurulentus*
Wings hyaline to yellowish, at least three silvery bands on abdomen 2

2. But three silvery bands on abdomen; pygidium bronzy to black; rarely spines between rows on upper side of hind tibiae 3
Four bands on abdomen 4

3. Femora largely rufous; face somewhat golden ..... *elongatus*
Femora largely black; face more whitish; bands on abdomen broad ..... *austrinus*

4. Tibiae and much of femora rufous; abdomen mostly rufous, large species; pygidium golden ..... *exornatus*
Femora mostly black, tibiae also 5

5. Abdomen wholly black; pygidium bronzy to black 6
Abdomen rufous, or yellowish, at least on basal part above 8

6. Pleura and propodeum strongly silvery sericeous, hair on propodeum above very short ..... *sericatus*
Pleura and propodeum only slightly if at all silvery sericeous; hair on propodeum longer 7

7. From the Middle and Eastern States ..... *pepticus*
From Kansas and Nebraska west ..... *sayi*

8. Pygidium golden to yellowish or paler; basal segment of abdomen at most with only short hair 9
Pygidium bronzy to black, basal segment plainly hairy at least on anterior sides 12

9. Two segments of abdomen rufous; hair on propodeum moderately long; usually but two spines above on hind basitarsus before tip; pygidium pale yellowish ..... *cressoni*
Three segments or more rufous 10

10. Outer side of hind basitarsus without a spine near middle; no hair on basal segment; body rather slender; abdomen usually wholly rufous or yellowish ..... *rufofasciatus*
Outer side of hind basitarsus with one or two spines near middle; some faint or sparse, fine hair on basal segment; abdomen broader 11

11. Hair on propodeum no longer than tibial spines; propodeum less sloping behind, from Texas ..... *brevipilis*
Hair on propodeum about twice as long as tibial spines; propodeum steeply sloping behind; from Washington and Oregon *hesperus*

12. Pleura and sides of propodeum with much silvery pubescence; bands on abdomen distinct ..... *fulviventris*
Pleura and sides of propodeum scarcely at all silvery; bands on abdomen not noticeable except toward sides ..... *utahensis*

Females of subgenus Tachynana

1. Abdomen wholly black, only fine bristles or none on posterior side of front tibiae 2
Abdomen more or less rufous or yellowish; distinct though short spines on posterior side of front tibiae 5

2. With but three silvery bands on abdomen; pygidium bronzy to black; spines above on hind tibiae very short and stubby *obscurus*
More or less white on four segments, though not always plainly in a band 3

3. Pygidium bronzy or coppery; abdomen shining, very small *parvus*
Pygidium golden, larger species 4

4. Abdomen shining, with silvery marks mostly on sides, hardly bands ..... *maestus*
Abdomen dull, with somewhat yellowish bands, almost complete *obductus*

5. Bands or spots of silvery on three segments only 6
Bands or silvery spots on the fourth segment also 7

6. Face silvery white; bands on abdomen white, thorax marked with silvery white; pygidium bright golden . . . . . *arizonicus*
Face dull golden or yellowish; bands on abdomen slightly yellowish; thorax and pleura with gray pubescence; pygidium rather pale golden, sometimes whitish toward base . . . . . *pattoni*

7. Spines on front (outer) side of hind basitarsus; hair on anterior sides of basal segment of abdomen; wings somewhat yellowish; hair on sides of mesonotum yellowish; spines above on hind tibiae very stubby . . . . . *abdominalis*
No spines on front of hind basitarsus; no hair or very faint on basal segment; wings hyaline; hair on sides of mesonotum white 8

8. Antennae short; third and joints beyond not twice as long as wide at tip; pygidium coppery; six or seven millimeters long *atomus*
Antennae longer; third and joints beyond fully twice as long as wide at tip; pygidium golden to almost coppery; ten to twelve millimeters long . . . . . *birkmanni*

Artificial keys to females

Females with pygidium coppery or bronzy to black

1. With but two segments with silvery bands, femora and tibiae black; all femora bare; wings dark . . . . . *aurulentus*
With three segments with apical silvery band 2
With four segments with apical silvery band 6

2. Tibiae black; thorax without white pubescence, no hair under hind femora; tibial spines short and stubby; pygidium with erect hair besides the depressed iridescent ones . . . . . *obscurus*
Tibiae rufous; no erect hair on pygidium 3

3. Femora yellowish or rufous; wings yellowish . . . . . *elongatus*
Femora black 4

4. No erect hair under hind femora; three spines on hind basitarsus *austrinus*
Hind femora hairy beneath; but two spines on hind basitarsus above before tip 5

5. Wings plainly yellowish; pronotum with yellowish pubescence; two whitish spots on mesonotum ..... *distinctus*
Wings scarcely yellowish; pronotum with white pubescence; no spots on mesonotum ..... *crassus*

6. Hind femora plainly hairy beneath 7
Hind femora bare 8

7. Tibiae and tarsi largely yellowish; a median groove on propodeum above ..... *mandibularis*
Tibiae and tarsi largely black; no median groove on propodeum above ..... *badius*

8. Less than ten millimeters long; hind basitarsus with but one spine above; pygidium coppery 12
More than ten millimeters long; hind basitarsus with three (or two) spines above; pygidium bronzy to black 9

9. Abdomen rufous on base 10
Abdomen wholly black 11

10. Thorax and propodeum with much white pubescence ..... *fulviventris*
Thorax and propodeum with little if any white pubescence *utahensis*

11. Entire body more or less silvery pubescent, or with a sericeous bloom in certain views; hair on propodeum very short ..... *sericatus*
Very little silvery pubescence; hair on propodeum much longer *pepticus* group

12. Abdomen reddish on basal part ..... *atomus*
Abdomen wholly black ..... *parvus*

Females with a golden pygidium

1. Abdomen partly red; practically no hair under hind femora, and other femora have little but appressed scale-like hair below; dorsal surface of propodeum without a median groove 2
Abdomen wholly black; often long hair on under side of all femora 9

2. Femora almost wholly rufous; mesonotum bordered with yellow pubescence; hind basitarsus usually with three spines above or golden ..... *exornatus*
Femora (and often tibiae also) almost wholly dark 3

3. Hind basitarsus with three spines above before tip; third joint of antennae plainly longer than fourth 4
Hind basitarsus usually with but two spines above before tip; third antennal joint scarcely, if any, longer than fourth 5

4. Hair on propodeum scarcely, if any, longer than the spines on upper side of hind tibiae ..... *brevipilis*
Hair on propodeum mostly twice as long or more than the spines on upper side of hind tibiae ..... *hesperus*

5. Fourth abdominal segment black and without silvery or pale band; wings hyaline 6
Fourth segment with at least some trace of a silvery or pale band 7

6. Face and clypeus silvery white ..... *arizonicus*
Face and clypeus yellowish to golden ..... *pattoni*

7. Wings hyaline; band on abdomen slightly yellowish, face with yellowish to golden pubescence; mesonotum with silvery appressed hair on disc; sides of pygidium slightly convex *birkmanni*
Wings more or less yellowish 8

8. Pygidium triangular, sides straight; face white; tibiae often partly rufous ..... *rufofasciatus*
Pygidium more slender; last two segments of abdomen black; tibiae and most of tarsi black ..... *abdominalis*

9. Hind femora without hair below; tibiae black; rather small species 10
Hind femora hairy below; tibiae usually rufous (except *ermineus*) 11

10. Wings somewhat yellowish; abdomen above finely pilose, not shining ..... *obductus*
Wings not yellowish; abdomen above largely shining, and white bands scarcely noticeable ..... *maestus*

11. Tibiae black (with silvery sheen); body very largely silvery *ermineus*
Tibiae rufous or yellowish ..... see no. 7 of *Tachyplena* p. 406

Females with a whitish or silvery pygidium

1. Tibiae pale; long spur of hind tibiae longer than basitarsus, at least a little 2
   Tibiae black; long spur of hind tibiae not longer than basitarsus. 3
2. Propodeum with more yellowish pubescence; second, third, and fourth silvery bands bending forward toward middle, away from hind margin of the segment ..... *belfragei*
   Propodeum with more grayish pubescence, all bands following the hind margin of segment ..... *calcaratiformis*
3. Abdomen reddish on first two segments above, although not wholly so; gray hair on propodeum, hair on basal abdominal segment very short ..... *cressoni*
   Abdomen wholly black; white hair on propodeum; hair on basal segment of abdomen moderately long ..... *foxi*

Females with three spines on hind basitarsus, and hind femora bare

1. Abdomen with silvery bands on but two segments; wings very dark; pygidium bronzy ..... *aurulentus*
   Abdomen with silvery bands on only three segments; pygidium bronzy 2
   Abdomen with silvery bands on four segments, or the abdomen partly rufous 4
2. Legs, including tibiae and most of tarsi, black; some specimens of ..... *obscurus*
   Legs with tibiae rufous or pale 3
3. Femora largely yellowish or rufous ..... *elongatus*
   Femora black, except tip ..... *austrinus*
4. Femora yellowish or rufous; abdomen partly rufous ..... *exornatus*
   Femora black, and usually tibiae 5
5. Abdomen at least partly rufous 6
   Abdomen black 10
6. Pygidium bronzy 7
   Pygidium golden 8
7. Silvery pubescence on pleura ..... *fulviventris*
   Little if any silvery pubescence ..... *utahensis*

8. Third antennal joint scarcely longer than fourth; abdomen almost wholly yellowish, some specimens of..... *rufofasciatus*
Third antennal joint plainly longer than fourth; abdomen with apical half black.....9

9. Hair on propodeum above extremely short..... *brevipilis*
Hair on propodeum moderately long..... *hesperus*

10. Thorax with much silvery pubescence; hair above on propodeum very short..... *sericatus*
Thorax almost devoid of silvery pubescence; hair above on propodeum moderately long.....11

11. From Kansas and Nebraska west..... *sayi*
From Illinois east and south..... *pepticus*

Males of subgenus Tachyplena

1. Tibiae largely black.....11
Tibiae mostly rufous.....2

2. Hind and mid tarsi without spines or only minute ones.....3
Hind and mid tarsi with normal spines.....5

3. Wings plainly yellowish; hair and pubescence of thorax plainly golden..... *distinctus*
Wings not so plainly yellowish; hair more white or gray.....4

4. Eighth ventrite ends in widely separated points; sixth ventrite without short erect hair each side..... *mandibularis*
Eighth ventrite with points closer together; sixth ventrite with patch of short, erect, black hair each side..... *crassus*

5. Only three segments bordered with silvery; face bright golden *auricomanes*
Fourth segment with silvery.....6

6. Some segments near tip with a tuft of hair each side on venter, sometimes a trace of a fifth band on abdomen.....7
No tufts of hair on venter near tip, nor any silvery on fifth segment.....8

7. With two tufts each side (sometimes rubbed); last ventrite ends with a very narrow notch in middle, late summer..... *harpax*
With but one tuft each side; eighth ventrite has a broad triangular excision between the large, triangular teeth; early summer *columbiae*

8. Next to last ventrite with an apical, transverse band of dense, erect, dark hair; face whitish; third joint of antennae longer than fourth; last ventrite ends in a broad triangular median excision ..... *validus*
No such band of hair, or face golden 9

9. Face golden; third antennal joint scarcely longer than fourth; wings yellowish ..... *praedator*
Face whitish; third joint of antennae plainly rounded below ... 10

10. Third joint of antennae hardly longer than fourth; no distinct median process to clypeus; eighth ventrite ends in broad, blunt tooth each side; southern ..... *calcaratus*
Third antennal joint longer than fourth; clypeal margin with a small, median, bilobed process more or less distinct; eighth ventrite with the teeth plainly more pointed; northern *calcaratiformis*

11. Hind femora hairy below to tip; parameres slender tapering to a fine tip 12
Hind femora hardly hairy beyond middle, parameres broad, flattened 13

12. Mesonotum not bordered with pale pubescence ..... *floridanus*
Mesonotum bordered with pale pubescence ..... *crmineus*

13. Parameres broad at tip; third joint of antennae hardly twice as long as the second ..... *comanche*
Parameres pointed at tip; third joint of antennae plainly more than twice as long as the second ..... *badius*

Males of subgenus Tachytes
(joints of antennae not rounded below)

1. Front femora with a groove across base on under side; front coxae with projection at tip 2
Front femora without such groove; front coxae without projection 7

2. Tibiae yellowish or rufous 3
Tibiae black 5

3. Abdomen above with some reddish in bands ..... *rufofasciatus*
Abdomen black, except silvery bands 4

4. Four silvery bands on abdomen; hind femora partly black *elongatus*
   Three silvery bands on abdomen; hind femora nearly wholly rufous ..... *seminole*

5. But three bands on abdomen; wings very dark on costal part *aurulentus*
   Four silvery bands on abdomen 6

6. Third joint of antennae longer than fourth; front side of hind basitarsus without spines near middle; wings yellowish .. *apache*
   Third joint of antennae scarcely equal to fourth; a spine on front side of hind basitarsus near middle; wings hyaline ... *sericatus*

7. Abdomen more or less reddish on basal part 8
   Abdomen wholly black, except the silvery bands 13

8. Eleventh joint of antennae widened on inner side, next joints more slender ..... *fulviventris*
   Eleventh joint not widened at tip 9

9. Twelfth and thirteenth joint plainly broadened, thirteenth hardly twice as long as broad at base ..... *spatulatus*
   These joints not noticeably broadened, the last tapering 10

10. Tibiae and hind femora reddish ..... *exornatus*
    Tibiae and hind femora black 11

11. But two segments reddish ..... *basirufus*
    Three segments reddish 12

12. Thorax and tip of abdomen deep black ..... *utahensis*
    Thorax and tip of abdomen grayish black ..... *hesperus*

13. Eleventh joint of antennae widened at tip; Eastern species *pepticus*
    Eleventh joint not widened at tip; Western species ..... *sayi*

Males of subgenus Tachynana

1. Tibiae and tarsi yellowish 2
   Tibiae black, tarsi often partly dark 3

2. Face with no erect hair, only short fine pile; base of abdomen reddish above; groove of posterior slope of propodeum widened above ..... *pattoni?*

Face with erect white hair; no reddish on abdomen; groove of posterior slope of propodeum not noticeably widened above ..... *minor*

3. Hair on vertex about as long as scape of antennae .... *hirsutifrons*
Hair on vertex shorter 4

4. Abdomen with silvery bands on but three segments; groove on posterior slope of propodeum widened above; hair in ocellar region white ..... *parvus*
Abdomen with some white or yellowish on sides of fourth segment 5

5. Abdomen with some white or yellowish hair on sides of fifth segment also 6
No white or yellowish hair on sides of fifth segment 7

6. Abdomen shining; hair on vertex moderately long ..... *maestus*
Abdomen dull; hair on vertex very short ..... *obductus*

7. Antennae very short, fourth and fifth segments and most of these beyond not twice as long as wide at tip; very small, 5 to 7 millimeters 8
Fourth and fifth and some other joints of antennae fully twice as long as wide at tip 9

8. Groove on posterior slope of propodeum widened V-shape above ..... *minutus*
Groove on posterior slope of propodeum not noticeably widened above ..... *amiculus*

9. Vertex width hardly more if any than one-third the basal width of face ..... *Tachyoides mergus*
Vertex width much more than one-third basal width of face ... 10

10. Face with silvery hair above antennae quite long; tarsi mostly dark; a bunch of short brown hair each side on ventral segments near tip of abdomen ..... *obscurus*
Face with dense silvery appressed hair, little erect above antennae; tarsi beyond basitarsus usually pale; abdomen more shining above, shorter hair on basal segment ..... *intermedius*

Genus TACHYTES

Subgenus TACHYPLENA

Tachytes mandibularis Patton

Common in the Eastern States, mostly north of Carolina, but one specimen from Florida. Specimens from Nebraska, Colorado, and Texas have more yellow on the femora and are usually larger, and represent *T. propinquus* Rohwer; I saw the type in the National Museum. Males from Nebraska externally appear the same as eastern specimens, but preparations of the internal genitalia may show differences. The type (National Museum) of *T. duplicatus* Rohwer from Florida seems to be *mandibularis*.

Tachytes validus Cresson

It was described from Texas, the female with golden pubescence on the face, and the apical segment (pygidium) bright golden. Fox says face with bright silvery pile and pygidium clothed with silvery pile, but in the Belfrage collection in the National Museum are specimens marked as type which agree with the Cresson description; these, I believe, are the true *T. validus*. It would appear that the specimens at Philadelphia are not types; and that there has been some mixup.

Tachytes breviventris Cresson

In the M. C. Z. collection are two male Tachytes purchased by Packard from Belfrage (along with other Fossorial Hymenoptera). The smaller one has on pin "420", and a long folded label "420. Tachytes breviventris Cress. n. sp.". The other has on pin "418", and on the long folded label "418. Tachytes validus Cress. n. sp.". The smaller has more rufous on femora, otherwise they are alike; the eighth ventrite ends in two lobes, rather near together; on the sixth ventrite a low brush of dark brown erect hair, each side on fifth ventrite a small patch of similar hair, but hardly as high. The clypeus is the same in both, so I consider *T. breviventris* a synonym of *T. validus*.

Tachytes calcaratus Fox

Described from Florida and New Jersey; I have seen the types in the National Museum. I have examined specimens from Miami, De Fun-

iak Springs, and Monticello, Florida, all taken in October, also from Raleigh, in September, Sanford and Aberdeen, all North Carolina, and the last two taken in October.

It is very close to *T. calcaratiformis*, but the female with a distinctly golden pygidium, and the male lacks the bilobed process on clypeal margin, and the third antennal joint scarcely longer than the fourth.

Tachytes calcaratiformis Rohwer

Described from Van Cortlandt Park, New York City; I have not seen the female type, but Rohwer says it is like *T. calcaratus* except the pygidium is more silvery. This form is common in southern New York; specimens seen from Bronx Park and Bronxville, New York City, Sandy Hook, Long Island, Fisher's Island, Gardiner's Island, Mosholu, Nyack, and New Baltimore, New York, also from Provincetown, Cambridge, Needham, Mass., and Narragansett, Rhode Island. Externally the male appears to be the same as *T. calcaratus*, having the same spine-like process on each side of base of the eighth ventrite and this ventrite ending in lobes with convex outer sides.

Tachytes calcaratiformis var. coloradensis var. nov.

In color and markings similar to the typical form, the pygidium is white, the clypeal projection is a little broader and not as plainly bilobed; the pygidium has a longer slender apical part.

In the male the third antennal joint is hardly a bit longer than the fourth (in *calcaratiformis* plainly longer) and as much rounded below as the fourth; the tip of the eighth ventrite is narrower than in the typical form, and the lobe each side is more pointed.

Length ♀ 13 mm., ♂ 11 to 12.5 mm.

Holotype, Boulder, Colorado, August (Carpenter), M.C.Z. no. 25629; paratypes from White Rock, near Boulder, 13 August, and Wray, 17 to 19 August, both Colorado, in Amer. Mus. Nat. Hist. and M.C.Z.

Tachytes belfragei spec. nov.

This, I believe, is what Fox in his Revision calls the female of *T. validus*, with silvery pile on face and pygidium.

It is near to the northern *calcaratiformis* and to *calcaratus* (except in silvery pygidium). Face with silvery white hair, thorax with white hair and pubescence; abdomen with four silvery bands; these bands

do not follow the hind margin of the segment all across, but near middle bend forward; the pygidium white; femora black, rest of legs rufous; wings yellowish as in allied forms. The third joint of antennae is plainly longer than the fourth; the propodeum has a median groove above; hind basitarsus has two spines above, not as long as those of *calcaratiformis*, the front basitarsus has five or six spines; propodeum densely long-haired; the pygidium has straight sides (in *calcaratiformis* a little concave before tip).

Length ♀ 17 mm.

From Texas (Belfrage coll.) (Peabody Acad.). Acquired by Packard when he was at the Salem institution. Type M. C. Z. no. 25630.

Tachytes harpax Patton

Described from Waterbury, Conn., from both sexes, the female with golden pygidium; Wheeler took many at Colebrook, Conn. Fox puts as female one with silvery pygidium, probably *calcaratiformis*. This, doubtless, led Rohwer to describe *dubitatus*, which appears to be a female of *harpax*, but I have not seen the type.

Other specimens are from Englewood, New Jersey, Falls Church, Virginia, Lexington, Holliston, Dorchester, Scituate, and Wellesley, Mass.; North Conway, New Hampshire; Milwaukee, Wisc.; and Midland County, Michigan; mostly taken in late July, August, and September. Some males show traces of a white band on the fifth segment.

Tachytes columbiae Fox

This species is closely related to *T. harpax*. The hind femora are hairy below, hind basitarsus with two spines, front basitarsus with five; dorsal groove sometimes indicated, not as plain as in *mandibulatus*, *praedator*, etc. In most males there is a narrow white band at tip of fifth segment, at least on sides. The eighth ventrite has two sharp, triangular teeth at tip, rather near together.

Specimens have been taken at Falls Church and Glencarlyn, Virginia, in June and July; Beltsville, Maryland, 6 July; Da Costa, New Jersey, 28 July; Raleigh, 28 May, 8 June, Judson, 19 July, and Edgecombe Co., 23 June, all North Carolina.

Tachytes praedator Fox

This is one of the most brightly marked species, the golden of head and pygidium being very bright; the bands on abdomen are usually

slightly golden, sometimes strongly so; the wings more or less yellowish. The legs are largely yellowish, the front and mid femora often not one half black, and the hind femora black only near base. The hind femora are plainly hairy below, the hind basitarsus with two spines, the front with five, and a distinct dorsal groove on the propodeum. In the male the antennae are simple, the eighth ventrite rather slender and with two broad blunt teeth not far apart; hind tarsi with spines at tips of joints, the basitarsus with two or three other spines. It is not uncommon at Fedor, Texas; also found at Beltsville, Maryland, 6 July; Wilmington and Raleigh, North Carolina, early July; and a male from between Climax and Bainbridge, Georgia, 28 July (Amer. Mus. Nat. Hist.).

Tachytes floridanus Rohwer

I examined the type from Florida in the National Museum. It is much like a small *T. pepticus*, but the hind femora have distinct, though fine, white hair below, another male agreeing with this is from Southern Pines, North Carolina, 17 May (American Museum Natural History), another from Southern Pines, 29 May (N. Car. Dept. Agric.), one from Aberdeen, North Carolina, 29 May (N. Car. Dept. Agric.). The apical portion of antennae simple, the third joint a little longer than fourth; the hair on propodeum and basal segment of abdomen is long and white; the surface of propodeum shining; its posterior slope has a very broad triangular depression. I have seen no female to fit it.

Tachytes ermineus spec. nov.

Body and legs black; face densely covered with silvery white pubescence and erect hairs; antennae with silvery bloom, third joint plainly longer than the fourth, last joint tapering; thorax and propodeum with silvery pubescence and white hair; hair on mesonotum as long as that on vertex, that on propodeum very dense and longer; abdomen above with four fairly broad silvery bands, faintly interrupted in middle, basal parts of these segments with a silvery sheen, fifth segment at tip narrowly rufous, with black and some rufous hair; pygidium moderately slender, densely covered with appressed pale golden hairs, the dark margin of pygidium very prominent.

Front and mid legs behind with much appressed and some erect white hair, hind femora shining, but with some fine white erect hairs below; outer side of hind tibia and three joints of tarsus bright silvery, the spines here, as elsewhere, pale yellowish, on hind tibiae not extend-

ing on basal third; on upper edge of hind basitarsus but two spines before tip; front basitarsus with four rather long spines, and those on the next two joints still longer and very slender. Wings hyaline, veins yellowish, third submarginal cell extending beyond the marginal, the recurrent veins not especially close above. Clypeus broadly rounded below, no prominent teeth, but the lateral one distinct.

Male very similar in appearance; third joint of antennae a little longer than fourth, last joint tapering; legs with hair as in female, the hind femora with distinct fine white hair below; spines on legs more whitish; abdomen does not show the silvery sheen on basal part of segments, last segment wholly black, pygidium rather more tapering than usual; eighth ventrite with two moderately large triangular teeth nearly touching at inner base.

Length female 13 mm., male 11.5 mm.

From Lower Ranger Station, Pima Co., Catalinas, Arizona, 6 to 20, and 15 to 21 July, about 2700 ft.

Type and allotype in American Museum Natural History, paratype in M. C. Z. 25633.

T. ermineus bears a very close resemblance to *T. sericatus*, but is separated by the pale golden pygidium (bronzy to coppery in *sericatus*), with but two spines above on hind basitarsus (three in *sericatus*), and by the hind femora hairy below (bare in *sericatus*).

Tachytes crassus Patton

The hind femora are hairy below; two spines on hind basitarsus above, usually five on front basitarsus; a distinct groove on propodeum above. In male the hind tarsus has few if any spines; the eighth ventrite ends in two large triangular teeth, and before tip are tufts or brushes of short erect black hair (in *mandibularis* no such tufts, and eighth ventrite ends in two more widely separate points). In both sexes the abdomen appears black with scarcely noticeable silvery bands, these being narrow; in *mandibularis* the bands are distinct in both sexes.

Specimens seen from Wollaston and Waltham, Mass.; from Washington Co., Wisconsin; and Cambridge, Nebraska.

Tachytes auricomanes Bradley

The types (two males), which I have examined, are similar, as Bradley states, to *T. crassus*, but differ in having but three silvery bands on

abdomen, the fourth segment wholly black, and the hind tarsi with the spines at tips of the joints. Face golden; mesonotum not as prominently bordered with golden as in *T. distinctus*, propodeum with golden pile and long gray to yellowish hair; basal segment of abdomen with long white hair on basal part; femora black, but extreme tip and rest of leg beyond rufous. Hind femora with very distinct pendent hair on under side; no spine on outer side of hind basitarsus, none above; long spur of hind tibia not nearly equal to basitarsus.

Third antennal joint little longer than fourth, the fourth, fifth, sixth, and seventh joints a little rounded below.

On the sixth ventrite there is short erect hair across, not plainly higher and denser at each side; the eighth ventrite ends in two large, rather sharp pointed, triangular teeth.

Length 14 to 16 mm.

From Oglethorpe, Ga., 1 July (J. C. Bradley), in Cornell University collection.

This might be the true *T. distinctus* Smith, but Smith states that the mesonotum is bordered with golden, a character not so obvious here as with the insects I have interpreted as *T. distinctus*.

Tachytes distinctus Smith

This is the species, similar to *T. elongatus*, but with black femora, which Smith described from Georgia. Fox applied the name to Smith's "var. B", which is *elongatus;* the name must go with the typical form. I append a new description.

♀ Body dull black; face with yellowish to golden pubescence; antennae, including scape, black; mesonotum margined with yellowish pubescence, also each side of scutellum; on front part of mesonotum are two elongate, slightly separated silvery or yellowish spots of pubescence; pleura with a large spot of yellowish to golden pubescence; propodeum with rather long gray to yellowish hair, on each side an elongate patch of golden pubescence; abdomen with three silvery bands, about as broad as in *T. elongatus*, base of first segment with long white hair; pygidium bronzy to coppery. Femora black, except extreme tip, which with the tibiae and tarsi are fulvous; front and mid femora with appressed yellowish hair behind, outer side of hind tibiae golden; wings plainly yellowish with brownish yellow venation.

Face much narrowed above, vertex hardly wider than width of antennal bases; third joint of antennae plainly longer than fourth; clypeus with two small teeth each side; scutellum with a faint groove

behind; propodeum with median groove above; pygidium much as in *T. elongatus;* front basitarsus with four spines before tip, hind basitarsus with two spines above before tip, but none on outer side, spines at tips of tarsal joints of usual length; inner spur of hind tibia about as long as basitarsus; all femora hairy below, the hind femora with rather short, fine white hair.

The male is similar in color, but face more golden, and no submedian spots on mesonotum; four silvery bands, all narrow, and that on fourth segment only toward sides and very narrow; pygidium silvery; legs with femora more broadly fulvous at tip; the hair on mesonotum very short and gray.

Clypeal margin with three or four small teeth each side; antennae with fourth, fifth, sixth, and seventh joints convex below and slightly concave above. Mid and hind tarsi almost without spines, tips of one or two joints with one or two very short ones, and basitarsus with two or three minute ones above. Eighth ventrite ends in two teeth, scarcely sharp, rather far apart at tips, close together at base. On the sixth ventrite is a tuft of black hair each side, between the tufts the hair is lower, and less dense.

Length female 18.5 mm.; male 16 mm.

Female from Nome, Liberty Co., Texas, 22 June (Bequaert), male from Shierer, Terrebonne Co., Louisiana, 18 June (Bequaert); Raleigh, N. C., 12 July, Maysville, N. C., 11 July, and Marion, N. C., 8 July, taken by Brimley and Mitchell.

Tachytes foxi spec. nov.

Body, legs, antennae dull black, last tarsal joints rufous; abdomen above with an apical silvery band on four segments; tibial spurs rufous; the spines on tibiae and tarsi white. Wings clear, veins fulvous.

Face and pygidium white; moderately long white hair on thorax, propodeum, and basal segment of abdomen; longer white hair on face, and short dark hair on vertex. Third joint of antennae plainly longer than the fourth; middle of clypeal margin slightly but broadly projecting and nearly truncate, no distinct lateral teeth; propodeum above without a median groove, the apical pit connected to the broad furrow on posterior slope.

Pygidium moderately broad at base, apex rounded. All femora have some white hair below; on hind basitarsus are but two spines before the tip; the inner spur of hind tibia as long as the basitarsus.

Length, ♀, 12 mm.

Two females from Fedor, Lee Co., Texas, 6 May, 1909, and 17 May, 1898 (G. Birkmann). Type M. C. Z. no. 25634.

Tachytes comanche spec. nov.

Male. Black, legs black, except apical tarsal joints; face and base of mandibles with white hair; no silvery on pleura; hair on mesonotum short and dark, on propodeum long and white. Under hind femora there is some hair at least to middle. Four segments of abdomen with silvery apical band. Propodeum shows an apparent dorsal groove; antennae short, third joint a little longer than fourth. Eighth ventrite ends in two triangular points, rather far apart. Parameres are broader at tip than in *badius;* at the subbasal outer angle there are two long stout bristles, and in front for a short distance the edge is slightly concave; beyond are other, shorter bristles.

Length 12 mm.

From Fedor, Lee Co., Texas, 8 and 11 May (Birkmann). Type M. C. Z. no. 25694.

Tachytes badius spec. nov.

Black body, also antennae and legs except the pale last tarsal joint; wings hyaline. Face silvery, lower part of occiput also, mesonotum bordered with silvery, also pleura, posterior sides of propodeum, and four bands on abdomen; femora silvery below, and mid and hind tibiae above; pygidium coppery; long white hair on upper part of face, on propodeum, and on basal segment of abdomen. Clypeus with a slight process, rounded below, and somewhat sinuate each side before the lateral angle; third antennal joint a little longer than fourth; no median groove on propodeum above, behind with a moderately wide groove; pygidium moderately broad, with plainly convex sides and almost pointed tip; front basitarsus with four spines above before tip, hind basitarsus with three spines; spines on hind tibiae pale, slender; inner spur of hind tibiae equal to basitarsus; hind femora distinctly hairy below, as also other femora.

Length, ♀, 13 mm.

One female from Anhalt, Comal Co., Texas, 28 June (Bequaert). Type M. C. Z. no. 25632.

It differs from *T. pepticus* in hairy hind femora, clypeal margin, white border to mesonotum, small pit on propodeum, and in hair on

basal segment of abdomen about twice as long as in *T. pepticus*. The male, which I believe belongs to this species, since it has hair on under side of hind femora and occurs in the same region, is generally similar to *pepticus*, with short dark hair on mesonotum and long white hair on the propodeum. The third joint of antennae is a little longer than the fourth, the tenth and eleventh not broadened; the hind femora have white hair below, not dense, and little, if any, on apical third; the eighth ventrite has a large, rather sharp-pointed tooth each side, the emargination rather deep. The apical part of the paramere is broad, flattened above, angulated near base on outer side, and in front of this angulation a row of stiff, curved hairs, the lower margin (seen from side) is nearly straight; the penis has the tip very slender (seen from above), and not swollen much near middle.

Length of ♂ 11 to 12 mm.

From Lee Co., Texas, 17 May; Florence, Arizona, 28 July; Mesilla Park, New Mexico, 12 July; Colton, California; and Lowell Ranger Station, Pima Co., Arizona, 6 to 20 July (A.M.N.H.).

Subgenus TACHYTES

Tachytes aurulentus Fabr.

This large dark-winged species is readily known by having but two silvery bands in the female, and but three in the male. The femora are bare; the femora and tibiae dark, tarsi more or less rufous; the pygidium bronzy to black. The hind basitarsus (♀) has three spines above, front basitarsus with five before the apical one; the pit on the propodeum extends forward more than in many species, but there is no real dorsal groove; the antennae of the male not modified.

It is found in the Southeastern States, but has been recorded from New Jersey, and I have taken it at Falls Church, Virginia; collecting dates are usually from the end of July to end of September.

Tachytes elongatus Cresson

This species was regarded by Fox as the male of *distinctus*. Smith had two forms under *distinctus*, one, the principal description, with black femora, and a "variety B" with yellowish femora. Fox admits his *distinctus* is the variety B. However, the specific name cannot be applied to the variety. As localities Smith gave Philadelphia and Georgia. Smith's description of black femora agrees with a southern

species. Thus *elongatus* remains as the name of the common and widespread species which has been called *distinctus*, and the name *distinctus* must be applied to the form that is similar to *elongatus* but has the femora black. In the male the paramere has a large fringe of long spreading hairs or bristles at outer tip. It is most common in the Southern and Southwestern States, Texas to California, in the East rarely north of Washington, D. C., but in the West north to Nebraska and Colorado. Most of the far western males seen are smaller than the eastern ones.

TACHYTES ELONGATUS var. SEMINOLE var. nov.

Males. Similar to male of typical form, except that there are but three silvery bands on abdomen, and the hind femora are almost wholly rufous, and the amount of rufous on front and mid femora is more than in typical form. These markings are like those in the female of *elongatus*, rather than the male; hair on face white (instead of dull golden in *elongatus*). The eighth ventrite ends in two slender points far apart, the parameres have heavier bristles at tip than in *elongatus*, and more spreading.

Length 14 to 14.5 mm.

From South Miami, 13 August and Larkins, Florida, Oct. (both Graenicher). Type M. C. Z. no. 25692. Also one from Dry Tortugas, Florida (Thompson), Amer. Mus. Nat. Hist.

TACHYTES ELONGATUS var. APACHE var. nov.

Males. The two specimens are smaller than any *T. elongatus*, although size is variable. The femora are entirely dark (pale at extreme tip in *elongatus*); the tibiae also dark, except tip of front and mid pairs (wholly pale in *elongatus*), and tarsi partly darkened; hair on face and base of mandibles silvery white, and long white hair on propodeum. The body is slender as in *elongatus*, and the bristles on parameres similar.

Length 12 mm.

From Patagonia, Arizona, 20 August (Bequaert); and Tucson, Arizona (Snow). Type M. C. Z. no. 25693.

TACHYTES AUSTRINUS nom. nov.

T. contractus Fox is preoccupied by *T. contractus* Walker 1871, so a new name is necessary. Besides the type of *T. contractus* Fox I have seen but one female, this from Monticello, Florida, 16 August.

The hind femora are bare; three spines above on hind basitarsus, four on front basitarsus and no groove on dorsum of propodeum.

Tachytes sericatus Cresson

Described from Texas. I have females, but no male that appears to belong to it. The female has very short hair on propodeum above and on basal segment of abdomen. The pygidium is bronzy, but in one view could be called "dull silvery." The hind femora are bare, and the hair under mid femora is very short; hind basitarsus with three spines above, front basitarsus with four.

My females are from Fedor, Lee Co., Texas, June to August.

The male, which has been considered as that of *T. sericatus*, is much more slender than the female; face with snow-white hair, little above antennae; hair on thorax very short, but only slightly silvery; propodeum also with rather scant short hair on sides, above rather long and pale, on lower sides silvery; legs, with tarsi, mostly black, spines whitish, one near middle of outer side of hind basitarsus; abdomen shining; silvery bands on four segments; very short hair on basal segment, but longer on anterior sides.

Third antennal joint a little shorter than fourth; vertex rather narrow; groove on propodeum widened, but not so much as in female. Abdomen slender, eighth ventrite ending in two slightly divergent slender prongs; long spur of hind tibiae not quite as long as basitarsus.

From above the parameres are flat, moderately slender, and obliquely narrower from outer side to tip. Seen from the side, the laciniae are long, the short apical part apparently separate, with a rounded lobe above near base; the lower side of laciniae fringed with long, fine hair.

Length 10 to 11.5 mm.

From Fedor, Texas, Valentine, Texas, 8 July, and Steins, New Mexico, 14 July (Bequaert).

Tachytes pepticus Say

Say gives Indiana as locality; in the collection of the American Museum of Natural History is a male from Lafayette, Indiana; this male agrees with Say's description in having the pubescence of face and the spot at base of mandibles somewhat golden, from above only is the face white. Prof. Brues has taken various other specimens near Chicago and northern Illinois, Graenicher had a pair from Milwaukee, Wisconsin, and Dreisbach has taken it in Michigan.

These are all easily separable from western specimens by the male genitalia and the marks of head when not discolored; the points of the eighth sternite are more widely separated. In the male the tenth and eleventh joints of the antennae are plainly broadened, the tip of eleventh being broader than base of the twelfth.

The specimen (♂) from Lafayette, Indiana, 16 Aug. 1920, about 550 ft. alt., I make the neotype; it is in the Amer. Mus. Nat. Hist.

Besides the localities mentioned, I have seen specimens from Woods Hole, Massachusetts; Southern Pines and Raleigh, North Carolina; Miami, Florida; Auburn, Alabama.

I consider *T. pennsylvanicus* Bks. based on males from Rockville and West Fairview, Pa., July and August, as at most a form of *pepticus*. At the time of description I had not seen the true *pepticus*, and Fox used *pepticus* for the western species here described as *sayi*. The specimens seen, types and some from St. Louis, Mo., one from Kentucky (Sanborn), are larger, and the eighth ventrite is plainly proportionally broader than in the typical *pepticus* from the Central States; the male from Woods Hole is somewhat intermediate, and none of the eastern males seen have as narrow an eighth ventrite as the typical form. Compared with the width of face below the vertex is narrower than in the true *pepticus*. The parameres are broader toward tip seen either from above or from side than in typical *pepticus*, and less sharp-pointed, but in *pepticus* there is some variation, so I leave it as a variety or form of *pepticus*. I have seen no eastern females that would go with it. The males from Fedor, Texas differ slightly from typical *pepticus*. (See Fig. 12.)

TACHYTES SAYI spec. nov.

This is the western representative of *pepticus*, which Fox treated as *pepticus*. The male is separated from *pepticus* by having the base of mandibles with white pubescence and the hair on face silvery white in most views, except directly in front. The hair on propodeum is fully as long as in *pepticus*. The tenth and eleventh joints of antennae are not widened, and the twelfth not narrower. The body (phallus) of the male genitalia is more slender than in *pepticus*, the parameres, though curving slightly, are not nearly so curved nor so widespread as in *pepticus;* the tip of each paramere is truncate; the penis is moderately slender near tip but not so noticeably widened near middle as in *pepticus;* the eighth ventrite ends in a triangular tooth each side, the two not so far apart as in *pepticus*. The bands and amount of thoracic pubescence are about as in *pepticus*.

Length of ♂ 10 to 12 mm.

The holotype is from Clear Creek, Colo., taken many years ago by Oslar. Others from the same locality; Cambridge and Bartley, Nebraska; Hot Springs and Buffalo, S. Dakota; and Lee County, Texas, where dated all in July; also Provo, Utah, 20 July to 1 August; and Jim Creek, near Boulder, Colorado, 3 August (A.M.N.H.). Type M. C. Z. no. 25673.

The females differ little from *pepticus*, and I see no structural difference. Specimens are from Berkeley, Colorado; Elmo, Kansas; Canton, S. Dakota; and Spokane, Washington, mostly August.

Tachytes fulviventris Cresson

This was described from a female, Colorado. The type has long hair on propodeum. The hind femora are bare; the hind basitarsus has three spines above, the front four. The abdomen has three segments rufous. Specimens before me are from Dragoon Mts., 20 July and Bonita, 12 July, both Arizona, taken by Bequaert; Sierra Blanca, El Paso Co., 8 July, and Valentine, 8 July, both Texas and by Bequaert; Davis, Calif., 30 June (Bohart); Finney Co., Kansas, August (Snow). Also in American Museum from La Junta, Colo., 12 August; Wray, Colo., 17 August; Crook, Colo., 24 August; Sabino Basin, Ariz., 8–20 July, and Marfa, Tex., 3–6 July. Recorded from Nebr., Mont., and Wash.

Tachytes fulviventris var. inferioris var. nov.

This form is distinguished by having but two segments of abdomen rufous; the hair on propodeum is as long as in the typical form, and other characters similar.

Length 12 to 13.5 mm.

This is the variety found in Lafayette, Indiana and northern Illinois. Type M. C. Z. no. 25695, also paratype in Amer. Mus. Nat. Hist., and two in the Birkmann collection without locality, possibly Texas.

Tachytes brevipilis spec. nov.

In appearance much like *T. fulviventris*, the first three segments of the abdomen being rufous, but the hair on the propodeum is not one half as long, and the pygidium is golden not bronzy. The hair on vertex is also only about one half as long as that of *fulviventris;* the

third joint of antennae is a trifle longer than the fourth, not as much so as in *fulviventris*. The hair on face and clypeus is plainly yellowish, not the silvery of *fulviventris*. There is some silvery pubescence on each side of the propodeum toward tip; on the base of the first abdominal segment the hair is also short. The legs are black, but three or four tarsal joints rufous; the hind femora are not hairy below, and the other femora have a silvery pubescence below; there are four spines on the front basitarsus before tip, and three on the hind basitarsus as in *fulviventris;* the long spur of hind tibia is equal to the basitarsus.

Length 15 to 17 mm.

Three females from Lee Co., Texas, June (Birkmann). Type M. C. Z. no. 25636. The male is not yet known.

TACHYTES HESPERUS spec. nov.

Body black, first three segments of abdomen rufous; the hair on face is grayish; there are some patches of silvery on pleura and propodeum but not prominent; the pygidium is yellowish to golden. The clypeus is rounded below, with a few small teeth each side; the third joint of antennae a little longer than the fourth; the hair on propodeum is white, almost as long as in *fulviventris*, there is no median groove on dorsum, the pit is crossed by fine striae. There are four spines on front basitarsus before tip, three on hind basitarsus above as in *fulviventris*. The wings are hyaline, venation yellow-brown, the third submarginal cell extends beyond the marginal; no hair under hind femora.

The male is similar, but hair on face is white; the third joint of antennae is little longer than the fourth, the third joint from tip not widened and the apical joint slender and tapering. The eighth ventrite with narrow points and widely separated, more so than in *basirufus*.

From *fulviventris* the female is separated by the pale pygidium; from *brevipilis* by having much longer hair on propodeum. The male is separated from *spatulatus* and from the male accredited to *fulviventris* by the unmodified apical segments of the antennae, as well as by the shape of the eighth ventrite.

Length ♀ 14 to 16 mm., ♂ 12 mm.

Several from Spokane, Washington, 21, 22 July, Yakima City, Washington, 2, 3, 4 July, and Umatilla, Oregon, 24 June, all taken by Samuel Henshaw in 1882; also from Oregon, in the American Museum of Natural History. Types in M. C. Z. no. 25637; paratypes there and in A.M.N.H.

Tachytes utahensis spec. nov.

Black like *T. pepticus*, with silvery face and hardly any pale pubescence on pleura, but the first three segments of abdomen are rufous above and below. There is more and longer erect hair on each side of the face; the hair on propodeum is long like *pepticus*, and the pygidium is bronzy. The sides of pygidium are slightly concave. The propodeum above has no median groove, the apical pit is striated across bottom and connected to the broad, but tapering groove on the posterior slope. The hind femora are not hairy below; there are four spines on the front basitarsus and three on the hind basitarsus; the inner spur of hind tibia is almost equal to basitarsus. The wings are hyaline, veins brown, the marginal cell is more than four times as long as broad, longer than in *pepticus*, the third submarginal reaches beyond the marginal. The clypeus is rounded below, with an obtuse tooth each side.

The male is similar, but smaller and more slender, three segments rufous; third antennal joint not longer than the fourth, last joint tapering; the eighth ventrite shows two sharp points rather widely separated.

Length ♀ 15 mm., male 12 mm.

Type female from Watson, Utah, 29 July (Carpenter), M. C. Z. no. 25638. Allotype male from Provo, Utah, 29 July to 1 August, American Museum of Natural History. Paratypes from Eureka, Utah, 13 to 21 July, Glenwood Springs, Colorado, 22 to 29 July, and Yellowstone National Park, 4 August, in M. C. Z. and A.M.N.H.

Tachytes exornatus Fox

Described from a male from Las Cruces, New Mexico. It is our most handsome species.

The female (allotype) has the body and legs marked as in the male, and likewise the wings are yellowish and darker at tip. The pygidium is covered with dense, fine, bright golden hair. There are two spines on hind basitarsus above, four on front basitarsus; hind femora without hair below; no median groove on propodeum above, and third joint of antennae plainly longer than the fourth.

Length of female 16.5 to 18.5 mm.

Allotype from Tempe, Arizona, 2 August (Bequaert), another, same locality, 1 August, and one from Sabino Basin, St. Catalina Mts., Arizona, 8 to 20 July (American Museum of Natural History).

Tachytes rufofasciatus Cresson

Described from a male from Texas (Belfrage). Common at Fedor, Lee Co., Texas, in May and June. Also from Auburn, Lee Co., Alabama, 9 June; Southern Pines, North Carolina, 7 June; MacCollum, Couseta Co., Georgia, 8 June; Monticello, Florida, 25 May; and also from Davis and Colton, California; the latter rather larger, but appearing to be the same species. The males of *rufofasciatus* are usually quite dark, with paler bands, the female usually has the abdomen entirely rufous or yellowish. The wings always show somewhat yellowish, and the pygidium broader at base than in allied species.

Tachytes cressoni spec. nov.

Black; face and pygidium silvery; first and most of second abdominal segment dull rufous; abdomen above with four silvery bands; legs black, last few tarsal joints reddish; spines on tibiae and basitarsi white; upper surface of mid and hind tibiae silvery; femora only slightly hairy; head with white hair on face, darker on vertex, short and brownish on mesonotum; moderately long and gray on propodeum; upper part of sides of propodeum with white pubescence, rather faint except at tip; pleura and sternum with white hair. Wings scarcely yellowish, the veins yellow. Clypeus slightly swollen below, and slightly emarginate in the middle; third antennal joint a little longer than the fourth; propodeum with a median groove above distinct, on posterior slope moderately broad, widened at the turn and here striate. Pygidium moderately long, sides not concave, not as broad at base as *T. rufofasciatus*. Hind basitarsus with two spines on upper outer row before tip; front basitarsus with four before tip; the upper inner side of hind tibiae show five spines before tip, all short.

In fore wing the lower side of third submarginal cell is plainly longer than the outer lower side of the second cell; the long spur of hind tibia not longer than the basitarsus.

Length, ♀, 13 mm.

From Fedor, Lee County, Texas, 1 and 3 May (G. Birkmann), also Austin, Texas, 9 May (Brues). Type M. C. Z. no. 25631.

Tachytes spatulatus Fox

This is known from the male only. Specimens before me are from places in Colorado, North Dakota, Utah, Wyoming, and several from

Oak Creek Canon, Arizona (Snow coll.). The eighth ventrite ends in two broad, rather rounded lobes. It is possible that this is the male of *T. fulriventris*, instead of *T. caelebs* Patton, so placed by Fox.

Tachytes basirufus Rohwer

I have seen a type in Washington (U.S.N.M.). It has moderately long hair on propodeum; all basitarsi dark, with white spines; male only known. The eighth ventrite is rather slender, the apex with two broad, blunt teeth, not far apart. The hind femora have a few hairs on basal part below. It differs from other western males in shape of this ventrite. Specimens before me are from La Junta, Colorado, 12 August; Bluff, Utah, 7 July; and Mesilla Park, N. Mexico, 12 July. The female is unknown.

Subgenus TACHYNANA

Tachytes abdominalis Say

Described from Arkansas. I apply this name to specimens like the two here labelled by Cresson from Dallas, Texas (Boll), and have marked as neotype one with the Cresson label, and the number "166", and that of Hagen's list "355". These are recorded in Cresson's Hymenoptera Texana. Others come from Fedor, Lee Co., Texas (Birkmann) and Ft. Stockton, Texas, 5 July (Bequaert). In American Museum are two, Grand Junction, Colo., 17 July, and La Junta, Colo., 12 August. The legs are wholly black and the spines above on hind tibiae are very short and stubby; the pygidium is golden to whitish near base; two spines above on hind basitarsus and four on front basitarsus. In all specimens seen the rufous occupies the whole of the first three segments of the abdomen. Say mentions the white lunule on each side of the fourth segment. No male is known that appears referable to this species.

Tachytes obscurus Cresson

A deep black species with little silvery except on face; bands on but three segments of abdomen; the femora are bare, hind basitarsus with two spines, front with five or six.

This is a very common species at Fedor, Texas, June to September. Also Valentine, 8 July, Waco and Alpine, 30 Sept., Texas. I have taken

it in Washington, D. C. and Falls Church, Virginia, 14 August and 7 September; also from Willets, 24 August, and Swannanoa, 12 September, both North Carolina; Brinson, Georgia; Long Key, Miami, 15 August, 4 September, both Florida; and Tucson, Arizona. Recorded from Nebraska and Kansas.

T. texanus Cress. is considered the male, and I believe, correctly. The eighth ventrite ends in a slender spine each side, rather far apart. The fifth and sixth ventral segments at sides toward tip have a brush of low but erect brown hair.

Tachytes obductus Fox

Type came from Tennessee. Both sexes are common at Fedor, Texas in June. The wings are darkened, particularly the marginal cell; the bands on abdomen usually a little yellowish. The hind femora bare, hind basitarsus with two spines, front with five.

The male (allotype) is more slender than female, the wings less darkened, face silvery, thorax and propodeum nearly covered with whitish hair; four segments silvery at tip; antennae short, fourth joint a little longer than third; the groove on posterior slope of propodeum very slender; tibiae with few short, white spines; pygidium rather slender; eighth ventrite ends in two sharp points.

Length 9 to 9.5 mm.

Tachytes birkmanni Rohwer

Known only from females which appear to be not uncommon near Fedor, Lee Co., Texas. A rather slender-bodied species, with hyaline wings, silvery bands on four segments, faint in middle, but on sides extending forward; the median groove is linear; four or five spines on front basitarsus before tip, hind basitarsus with one or two spines above, no spine near middle of anterior side; pygidium slender, golden; tibial spines not as stubby as in *T. abdominalis;* third antennal joint fully twice as long as the second.

Tachytes minor Rohwer

Based on a male, much like *T. birkmanni* of which it may be the male. Third joint of antennae hardly twice as long as second, and not longer than fourth; vertex-width fully one half basal width of face; groove on posterior slope of propodeum linear; no spine on front

(outer) side of hind basitarsus; eighth ventrite with two short, rather well-separated points.

Besides the type, I have seen two specimens, also from Fedor, Texas, in the Birkmann collection.

TACHYTES PATTONI spec. nov.

This species is similar to both *T. rufofasciatus* and *T. birkmanni*. Like them, it is wholly black except the basal part of abdomen, which is rufous on three segments, in the other species often rufous on all segments. Like them, it has two spines above on hind basitarsus, four on front basitarsus, no hair under hind femora, no dorsal groove to propodeum, the pygidium is golden, and the spines on hind tibia are short and stout. It is smaller than most *rufofasciatus*, but is broader than most *birkmanni;* the pubescence on face and clypeus is dull golden like that on *birkmanni* (on *rufofasciatus* it is white). The bands on abdomen are not white as in *birkmanni*, but not as yellow as those of *rufofasciatus*, but it differs from both in having but three bands; the fourth and fifth segments in specimens seen (ten) are wholly dull black and no trace of a band on the fourth. The pygidium is less narrowed toward tip, and the sides slightly but plainly convex; the third joint of antennae is no longer than fourth; the wings are hyaline, venation yellowish; the pubescent patches on pleura and propodeum are hardly as prominent as in *rufofasciatus* and paler.

Length of body 8.5 to 9.5 mm.

Several specimens from Fedor, Lee Co., Texas (Birkmann), 17 and 21 June; one from Miami, Florida (A. E. Wight), taken in March, this last the holotype, M. C. Z. no. 25639.

A male from Raleigh, North Carolina, 16 June, might be the male of this species. The basal segment is partly reddish above, the tibiae and tarsi pale as in *T. minor*. It is not as slender as *minor* and there is no long erect hair on face, but only very short pile, which is certain views from above appears golden. The third joint of antennae only a little longer than the second, and shorter than the fourth; long spur of hind tibia about equal to hind basitarsus, latter without spines on the anterior side; eighth ventrite ends in two points rather far apart; the groove on posterior slope of propodeum is much widened above as in *parvus* and *minutus*. The hair on mesonotum is short and plainly yellowish, that on propodeum still shorter and white; the face does not show the two rounded elevations seen in *parvus;* in fore wings the top of the third submarginal cell is wider than the top of the second.

Length 7 mm.

Tachytes arizonicus spec. nov.

Black, but abdomen largely reddish, the last two or three segments black; legs black, tarsi more or less yellowish; face, back of head, borders of mesonotum, pleura, sternum, posterior sides of propodeum, and bands on three segments of abdomen silvery; mesonotum with dark, faintly yellowish pubescence in middle; pygidium golden; wings hyaline. Face with erect white hair, rather short; propodeum with moderately short gray hair; no hair beneath hind femora, others with white appressed pubescence. Clypeus below in a broad, evenly rounded lobe, projecting only a little; third joint of antennae hardly longer than fourth; propodeum without median groove above, that on posterior slope very narrow; spines above on hind tibiae very short and stout, rufous or brown; inner spur of hind tibiae about equal to basitarsus; two spines above on hind basitarsus, five above on front basitarsus; pygidium moderately broad, sides slightly convex; in fore wing the third submarginal cell reaches a little beyond the marginal cell.

Length ♀, 9.5 mm.

From Tempe, Arizona, 31 July and 2 August (Bequaert). Type M. C. Z. no. 25640.

Tachytes maestus Mickel

Black; tarsal joints more or less pale; pygidium golden; wings plainly a little yellowish; face, borders of mesonotum, pleura, sternum, posterior sides of propodeum, and four bands on abdomen silvery; some white also on last segment; the bands on second, third, and fourth segments are widened on sides; ventral segments also with some white pubescence, the abdomen generally shining. Hair on upper face rather short, long white hair on slope of propodeum and on base of abdomen.

Clypeal margin with a broad median lobe, with straight sides, and truncate across tip; third joint of antennae no longer than fourth; no distinct median line on propodeum above, behind the groove is narrow and short; pygidium rather broad, sides scarcely convex, except near tip; spines above on hind tibiae pale and sloping; inner spur of hind tibia about as long as basitarsus, hind basitarsus with two spines above before tip, front basitarsus with five spines above before tip.

In the male the colors are the same; the abdomen rather slender; the front coxae with a small apical tooth; hind tibiae with spines; the last ventral ends in two fine, widely separated spine-like points. The

abdomen is distinctly shining; the third antennal joint is as long as the fourth; the ventral plate ends in two widely separated slender points; the hair on pygidium is wholly depressed.

Length ♀ 9.5 mm., ♂ 8 mm.

From Tempe, Arizona, 30 July, 1 and 4 August (Bequaert); type was from Nebraska. *T. intermedius* is said to have suberect pile on the pygidium, pubescence sparser than in *obscurus* (here much more abundant); and pile on legs more or less golden (not in *maestus*).

I have examined a paratype of *maestus* in the National Museum.

Tachytes intermedius Viereck

I have identified as this species several males from Tempe, Arizona, taken by Bequaert in August. The hair on head and thorax is short; the clypeus and face below ocelli is bright silvery, the tarsi (except basitarsi) rufous; the pygidium is rather broad, the eighth ventrite ends in two widely separated sharp points, not unlike *obductus*, but more widely separated. The second and third abdominal segments are rather broadly margined with white, the first and fourth less broadly; there is no hair under hind femora, but white appressed hair on posterior sides of front and mid femora; the long spur of hind tibia is not nearly as long as basitarsus. I have not seen the type which was described from Douglas Co., Kansas.

Tachytes austerus Mickel

Described from Nebraska; I have not seen it, so it is not in the tables; the abdomen is partly red above, and is said to be similar to *T. abdominalis*, but with the clypeal margin strongly emarginate, and the recurrent veins not so proximate above.

Tachytes hirsutifrons spec. nov.

♂ Dull black, last tarsal joint scarcely paler, abdomen above somewhat shining; face and clypeus with silvery pubescence; vertex, thorax above, pleura, and base of abdomen densely clothed with very long grayish white hair, longer than in other species of the size, the hair on vertex equal to second plus third antennal joints; abdomen with four silvery bands and the pygidium silvery as usual; venter with a triangular silvery patch on each side of three segments. Front and mid femora very hairy below and behind, hind femora not; mid and hind tibiae silvery above.

Third antennal joint much shorter than the fourth, last joint slender, longer than the preceding; the second plus third, plus fourth scarcely, if any, longer than vertex-width. Clypeal margin with a moderately broad projection, the margin scarcely rounded; propodeum with no evident median groove; hind tibiae with two rows of very short pale spines above; hind basitarsus with one spine on outer side at middle and a minute one above; the inner spur of hind tibiae not as long as basitarsus.

In fore wings the marginal cell is fairly long so that the part of hind margin beyond the third submarginal is almost as long as the part before this point; the second submarginal cell is much broader above than the third submarginal.

The ventral plate ends in two small, rather widely separated points; the last three ventral segments with short, erect black hair; the pygidium is rather narrow at tip.

Length 8.7 mm.

From Tempe, Arizona, 2 August (Bequaert). Type M. C. Z. no. 25635.

About the size of *T. intermedius*, but with broader body, and dark tarsi, the long hair on vertex separates it, as well as from *T. texana* (the male of *obscurus*).

Tachytes parvus Fox

This was described from a male from Camden Co., New Jersey. I took a male at Beltsville, Maryland, 6 July; the American Museum of Natural History has a male from Valley of Black Mts., 27 August (Beutenmüller), and Dr. C. S. Brimley has taken both sexes at Raleigh, North Carolina, ♂ 29 July, ♀ 1 July, 13 September, and Tarboro, 29 July. The female is similar to the male, scarcely larger, black, the lower face and clypeus with white pubescence, and the abdomen with white pubescence on the sides of four segments, not forming bands; the abdomen is fully as shining as the male; the tarsi become rufous toward tip; the pygidium is moderately slender, the sides straight, and covered with rather coarse coppery hairs, no erect hair.

The clypeus is rounded below, a faint median excision and two or three teeth laterally. In front of the anterior ocellus is a raised area each side as in the male; the third antennal joint no longer than fourth, and about one half longer than second. The mesonotum has some short, dark hair, the propodeum with short, white hair above

and behind, much shorter than in male; some faint patches of white pubescence on pleura and sides of propodeum.

Front basitarsus with four short spines, hind basitarsus with one or two above before tip, and one on the outer side; the hind tibiae have moderately long sharp-pointed spines above; the long spur of hind tibia fully as long as basitarsus; hind femora have no long hair below (as in all related forms).

Length 6.5 mm.

The male is easily recognized by having but three silvery bands on abdomen, as well as by the raised areas on the face, and its small size and darkened wings.

Allotype ♀ from Raleigh, N. Carolina, 1 July 1932 (C. S. Brimley).

Tachytes minutus Rohwer

Described from Lee Co., Texas. I have seen a male from Raleigh, North Carolina which agrees with description; it has the groove on posterior slope of propodeum widened above as in *T. parvus;* there are four silvery bands, or rather spots, each side on abdomen, and the antennae are very short as in *amiculus,* there is more white hair on front femora than in *amiculus,* and the long spur of hind tibia is equal to the basitarsus (shorter in *amiculus*); the eighth ventrite has longer processes at the tip than in *amiculus;* I have seen the type in Washington.

Tachytes amiculus spec. nov.

♂ Black, last two or three tarsal joints yellowish; wings hyaline; face with short appressed silvery hair, front and vertex with longer erect hair, fine and pale; thorax with scattered white hairs, but no distinct borders, also some white on mesopleura and sternum; propodeum with short white hair on sides, in middle the hair is gray and indistinct. Abdomen above shining, basal segment without erect hair; white bands, broadly interrupted, on four segments, extending forward on sides; pygidium silvery.

Vertex almost one half basal width of face, clypeal margin rounded in middle, with a small tooth each side; antennae very short, second joint about two thirds of third, beyond the joints are not twice as long as broad at tip. Propodeum above deeply and closely punctate right up to the tip, where, instead of the spear-shaped fovea, appears a faint, angulate ridge; posterior slope also deeply punctate, the median

groove linear, not widened above in a V-shape. Femora more slender than in *T. parvus,* no hair on hind femora beneath; inner spur of hind tibia almost equal to basitarsus, latter without a spine on anterior side.

Eighth ventrite with a rather short, blunt tooth each side, tipped with a hair, not as slender nor as sharply pointed teeth as in *T. minutus.* Top of second submarginal cell longer than top of third.

Length 6 to 6.5 mm.

Type from Cold Spring Harbor, Long Island, N. Y., 24 July, on beach; paratypes from Raleigh, N. Carolina, 25 June, and Edgecombe Co., N. Carolina, 23 June in North Carolina Dept. Agriculture collection.

Differs from description of *T. minutus* in lacking the V-shaped widened groove of posterior slope of propodeum, in no impunctate area at end of upper side of propodeum; in more blunt processes at tip of eighth ventrite.

Tachytes atomus spec. nov.

A minute species; black, first three segments of abdomen rufous, tips of tarsi pale, pygidium coppery.

Lower face and clypeus with short, silvery hair, hair on upper part of face and on vertex extremely short, silvery back of eyes, also the usual elongate silvery band each side on collar. Mesonotum with silvery hair on sides by wings and behind, in middle with short bronzy hair; pleura as well as femora and tibiae silvery; abdomen with silvery spots on sides; propodeum behind silvery on the sides, sparse short hair above. Antennae with third joint no longer than the fourth; propodeum above with a very faint scar at tip, as in other small species the middle tip seems to project in a short point, groove on posterior slope very narrow. Abdomen slender, with sparse white hair below and toward tip above; hair on propodeum extremely short; but one spine above on hind basitarsus before tip, hind femora bare. Wings hyaline; marginal cell only a little more than three times as long as broad; shorter than in *T. birkmanni;* the third submarginal cell does not extend beyond the second further than the second beyond the end of third discoidal cell; in one specimen the two recurrents are very close together above.

Length ♀ 6 to 7 mm.

From Tempe, Arizona, 31 July (Bequaert). Type M. C. Z. no. 25641.

Tachyoides gen. nov.

The female of *Tachytes mergus* Fox (*obscuranus* Rohwer) differs from normal Tachytes in the long fusiform basal joint of the antennae; the clypeal margin has a much larger tooth each side, and the pygidium has but few scale-like hairs so that the dark ground color of the pygidium shows between the scales; the hind femora have no hair below, and that on other femora is short. The bands on abdomen are very broad on the sides. The groove on the slope of propodeum is linear, scarcely widened above. In the male the vertex is very narrow.

Besides the genotype, *T. mergus*, the genus includes one new species.

The male having much resemblance to Tachynana is separated in the table to males of that subgenus (cf. p. 409). The females of the two species separate as below:

Antennae with second joint about half the length of third, latter fully equal to fourth; basal joint longer than second, third and fourth joints together ..... *ariella*

Antennae with second joint not nearly one-half of third, latter longer than fourth; basal joint not longer than second, third, and fourth joints together ..... *mergus*

Tachyoides mergus Fox

Tachytes obscuranus Rohwer is a synonym, as is noted in the Washington collection. The female was described from Camden Co., New Jersey, and Rohwer described both sexes of *obscuranus* from Fedor, Lee Co., Texas, where it appears to be fairly common in June and early July, the males sometimes in late May.

The female has four spines on front basitarsus before tip, the hind basitarsus two spines above before tip, and one on outer side near middle. There is usually white scale-like hair on basal part of the second abdominal segment (not seen in Tachytes).

The male has no spines above or on outer side of hind basitarsus; the vertex is only about one third of the basal width of face; the eighth ventrite ends in two rather long, well separated sharp points.

Tachyoides ariella spec. nov.

Black, tips of tibiae and the tarsi yellowish; wings hyaline, veins yellowish. Face brilliantly silvery, back of head also; mesonotum with

anterior corners and a faint submedian stripe each side silvery; pleura, mid and hind femora beneath, tibiae on outer side, propodeum with a stripe each side, more or less plainly silvery; four abdominal segments with a large, silvery triangle each side, scarcely meeting in middle, and extending beneath. Pygidium with silvery scales, shorter than in *T. mergus*. Hind femora bare, other femora with some short erect hair beneath; spines on legs slender and pale; front basitarsus with four spines above, hind basitarsus with two; spines on hind tibiae above slender, inner spur of hind tibia fully as long as basitarsus. Clypeal margin with a stout, large tooth each side, much as in *T. mergus*. Antennae short and slender, basal joint longer than in *T. mergus*, longer than the second, third, and fourth joints together; second joint about one half of the third, latter as long as the fourth. Propodeum above shining, with a distinct median groove, pit not very broad, and on the posterior slope the groove is rather narrow. Pygidium triangular, sides straight.

Length 7 mm.

Female from Tempe, Arizona, 1 August (Bequaert). Type M. C. Z. no. 25642.

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EXPLANATION OF PLATES

PLATE 1

PLATE 1

Fig. 1. *Tachytes pepticus*, paramere, above.
2. *Tachytes seminole*, tip of paramere and brush.
3. *Tachytes apache*, tip of paramere and brush.
4. *Tachytes elongatus*, tip of paramere and brush.
5. *Tachytes obscurus*, paramere, above.
6. *Tachytes sayi*, paramere, above and from side.
7. *Tachytes badius*, paramere, above.
8. *Tachytes sericatus*, paramere, above.
9. *Tachytes sericatus*, paramere, side.
10. *Tachytes badius*, paramere, side.
11. *Tachytes comanche*, paramere, above.
12. *Tachytes pepticus*, paramere of Fedor specimen above and from side.
13. *Tachytes ermineus*, paramere, above.
14. *Tachytes pennsylvanicus*, lacina from side.
15. *Tachytes pepticus*, paramere Miami specimen.
16. *Tachytes pennsylvanicus*, paramere, from side.

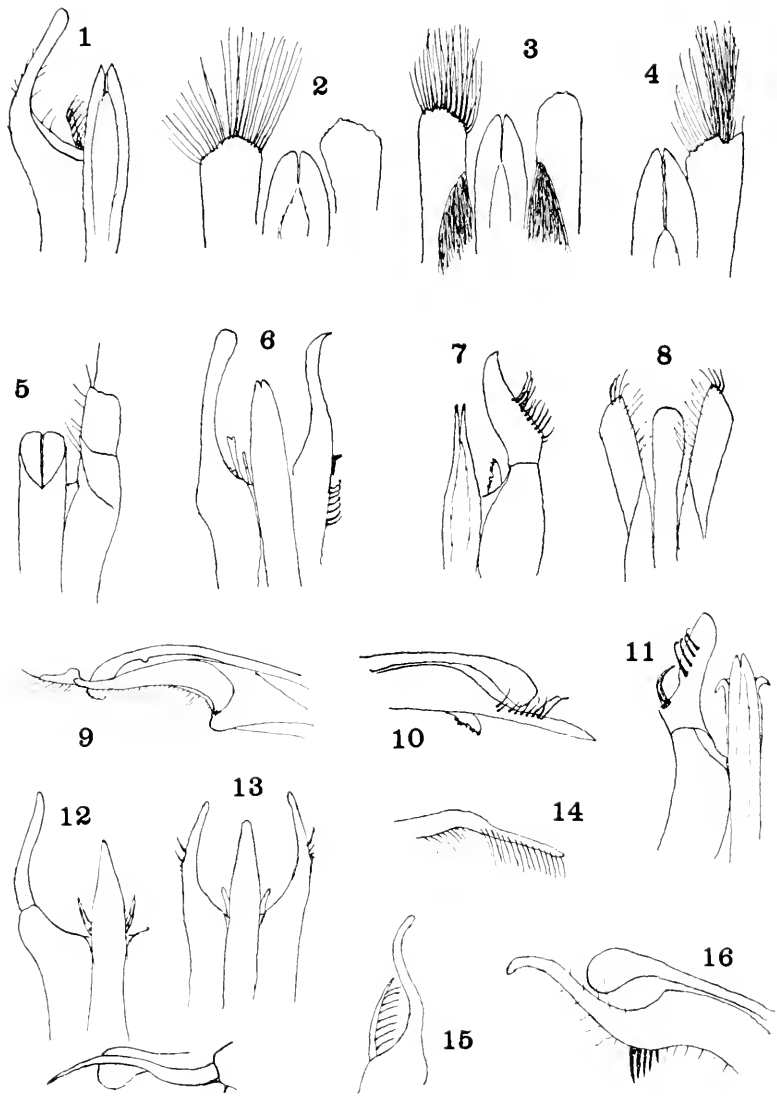
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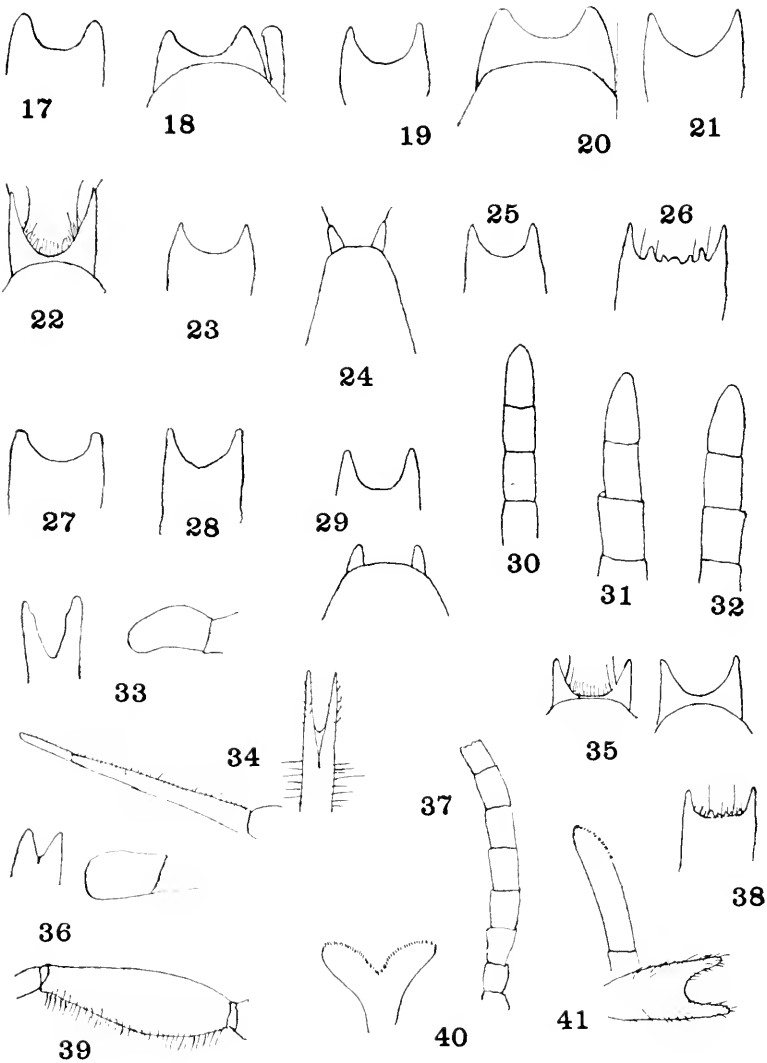
PLATE **2**

PLATE 2

17. *Tachytes pepticus*, apical ventrite of neotype.
18. *Tachytes pepticus*, tip of abdomen from above, Michigan specimen.
19. *Tachytes pepticus*, apical ventrite, Miami specimen.
20. *Tachytes pennsylvanicus*, apical ventrite.
21. *Tachytes crassus*, apical ventrite.
22. *Tachytes scricatus*, apical ventrite.
23. *Tachytes floridanus*, apical ventrite.
24. *Tachytes amiculus*, tip of abdomen, above.
25. *Tachytes auricomanes*, apical ventrite.
26. *Tachytes elongatus*, apical ventrite.
27. *Tachytes ermineus*, apical ventrite.
28. *Tachytes, badius*, apical ventrite.
29. *Tachytes sayi*, apical ventrite from below and above.
30. *Tachytes sayi*, apical part of antenna.
31. *Tachytes pepticus*, apical part of antenna, neotype.
32. *Tachytes pennsylvanicus*, apical part of antenna.
33. *Tachytes fulviventris*, tongue, side and above.
34. *Tachytes praedator*, tongue, side and above.
35. *Tachytes obscurus*, apical ventrite, two specimens, above.
36. *Tachytes rufofasciatus*, tongue, above and from side.
37. *Tachytes amiculus*, part of antenna.
38. *Tachytes obscurus*, apical ventrite from below.
39. *Tachytes floridanus*, hind femur.
40. *Tachytes aurulentus*, tongue from above.
41. *Tachytes mandibularis*, tongue, from side and above.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REVISION OF THE AFRO-ORIENTAL GECKOS OF THE GENUS PHELSUMA

BY ARTHUR LOVERIDGE

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No. 10.—*Revision of the Afro-Oriental Geckos of the Genus Phelsuma*

By Arthur Loveridge

Not since Boulenger (1885d, p. 209) monographed this genus fifty-six years ago has any revision been attempted. At that time 8 species were recognized, the same number as Mocquard (1909, p. 19) included in his key to the Malagasy species a quarter-of-a-century later. Rendahl (1939a, p. 263), in connection with a report on a collection from the Seychelles, gave a resumé of 13 species and described 6 more, of which unfortunately I can recognize but two. Dr. Rendall was severely handicapped by the very scanty comparative material at his disposal.

In this respect the Museum of Comparative Zoölogy, with 17 of the 23 species now recognized, is more fortunately placed. This is largely due to the energetic and far-sighted policy of Dr. Thomas Barbour who assembled them over a period of years. It is with particular appropriateness and pleasure, therefore, that I associate his name with the only novelty here described:

Phelsuma barbouri spec. nov.

A paratype of this new species is in the American Museum of Natural History, whose entire Phelsuma collection was generously placed at my disposal by Mr. C. M. Bogert. I have also to thank Dr. D. Cochran for submitting a species in the United States National Museum, and Mr. V. FitzSimons of the Transvaal Museum for answering questions regarding the type of *standingi*. Under present conditions it is not surprising that queries regarding certain species addressed to European museums have gone unanswered for the letters may not have reached their destinations.

One conclusion that must remain questionable is my action in referring *cepediana* to the synonymy of *inunguis* (*vide* pp. 7, 11). For many years half-a-dozen species were assigned to *cepediana* (1820) by the earlier herpetologists and resulted in much confusion, a confusion largely due to the homogeneous character of the lizards comprising this difficult genus.

In this connection it might be as well to point out the relative importance of the characters here employed for separation of species.

While snout length does assist in defining certain groups, its value has been, and is, largely masked by the vagueness with which it was formerly expressed. Its usefulness will be fully established only when

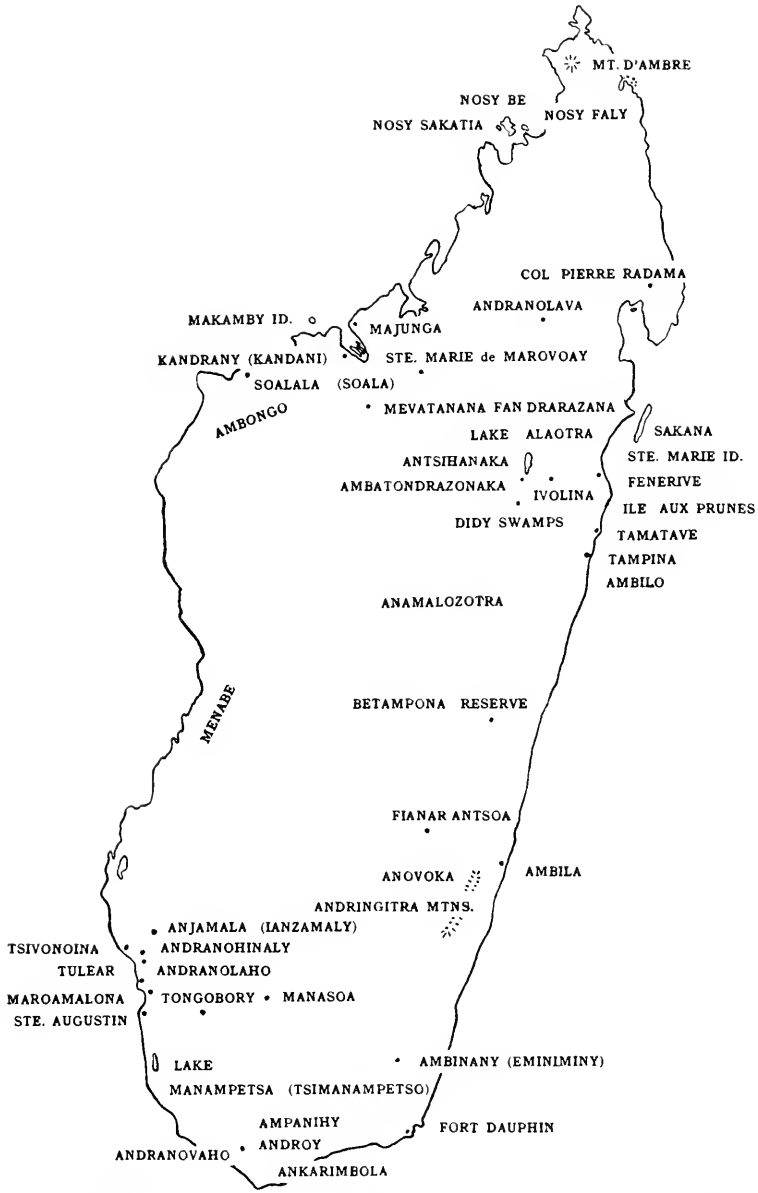
long series of age and sex of each species have been recorded. The presence, or absence, of a median cleft on the rostral is extraordinarily constant in several species of which good series are available; in others, however, it appears to be of little value. Apparently only in the Mauritius group of islands does one find the nostril bordered by the rostral and the centre of the nostril immediately above the suture between rostral and first labial. So far only two species (*mutabilis* and *breviceps*) have been recorded with less than the standard number of 3 nasals. While in a majority of species the normal number of intersupranasal granules is 2, with 1 or 3 as less frequent variants, in several well-known species a single granule appears constant. The number of labials, whether upper or lower, appears of little consequence excepting for two species (*mutabilis* and *breviceps*) where reduction is correlated with a shortening of the snout.

Boulenger (1885d) sometimes designated the dorsals "granular scales;" as I have been unable to know where to draw the line between those species where such a term is reasonably applicable and those species where "granules" is more appropriate, I have used the shorter term throughout. It is interesting to note that the ventral scales are smooth in all species except *trilineata, lineata, bimaculata, quadriocellata* and *astriata*, and in some of these so obtusely as to be scarcely noticeable at times. The number of subdigital lamellae of the fourth toe serves only to differentiate the two species *mutabilis* and *breviceps*. The subuniform or transversely dilated character of the subcaudals appears to me to offer the most important indication of relationships which we have, so that it is unfortunate that it was not employed by Rendahl when describing *sundbergi* and other forms from the Seychelles.

As a result of these studies several species have had to be referred to the synonymy, viz.

Gecko cepedianus Merrem = ? *P. inunguis* (Cuvier)
Phelsumia lineata var. *bifasciata* Boettger = *P. lineata* Gray
Phelsuma carinatum Rendahl = *P. astriata* Tornier
Phelsuma carinatum maheense Rendahl = *P. astriata* Tornier
Phelsumia laticauda var. *comorensis* Boettger becomes *P. dubia comorensis* Boettger
Phelsuma pulchrum Rendahl = *P. m. longinsulae* Rendahl
Phelsuma pulchrum cousinense Rendahl = *P. m. longinsulae* Rendahl
Phelsumia micropholis Boettger = *P. mutabilis* (Grandidier)

In Madagascar there appears to be a fairly well-marked division as between those species found in the drier west and those occupying the



Map of Madagascar showing approximate position of all localities in which Phelsuma have been collected

mountainous and more humid east, though towards the extreme north and south such a division tends to disappear. In view of the difficulties I have encountered in locating many Malagasy places, largely owing to the haphazard way in which prefixes and suffixes are attached to root names, a map is furnished showing the approximate positions of localities as located on the best map known to me, that of G. Grandidier and J. Hanson (1925, Pub. by Soc. d'Edit. Geog. Marit, et Coloniales).

The spellings on that map are accepted and those of herpetologists placed in parentheses, except for the following:
Andranohinaly (Boettger), though probably ANDRANOHINALAHY (of the map). Andranovaho (Angel) though quite possibly ANDRANOMAVO (of the map). *Angurutani (Boettger) of Northwest Madagascar, which I failed to find. Ankarimbola (Ankarimbela: Boettger) given as KARIMBOLA (on the map). Col Pierre Radama (Mertens) not found unless COL AMBATONDRADAMA (of map). *Fierin (Grandidier, 1869) though probably FIRINGA, S. W. Mad. (of map). *Tanosy (Kaudern) not found, though obviously near Manasoa and Tulear. Tsianovoka (Angel; Anevoka: Boettger) not found though S.S.W. of Fort Carnot and Mt. Ikongo in eastern Madagascar.

Genus Phelsuma[1]

1825. *Phelsuma* Gray, Ann. Philos., **26**, p. 199 (type *Gecko cepedianus* Merrem).

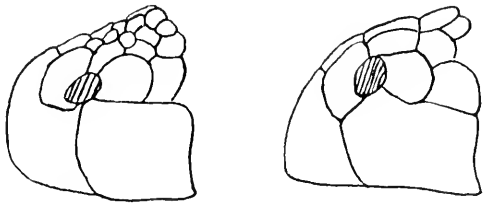
1830. *Anoplopus* Wagler, Nat. Syst. Amphib., p. 142 (type *Gecko cepedianus* Merrem).

Digits clawless or with a vestigial claw, not webbed, thumb and inner toe vestigial and not dilated, remaining digits subcylindrical at base, below covered by scales which distally are replaced by transversely dilated shields merging into the undivided transverse lamellae of the strongly dilated discoid apex, which is without free terminal phalange. Body more or less depressed, dorsal lepidosis of juxtaposed, subuniform granules, below with smooth, subhexagonal, imbricate scales; tail also depressed, covered above with granules, below with larger imbricate scales. Pupil round; eyelid distinct all round the eye. Males with preano-femoral pores forming an uninterrupted series; both sexes with a pair of small, transverse, post-anal slits.

* Omitted from map accompanying this paper on account of failure to locate.

[1] Boettger (1913) emended the spelling to *Phelsumia*, but this seems undesirable. Though named for van Phelsum, the noun has a feminine ending which makes it advisable to have all the adjectival specific names in agreement.

Range. Coast of Tanganyika Territory[1] and islands of the Indian Ocean (Zanzibar; Pemba; Seychelle; Amirante; Aldabra; Comoro; Madagascar; Mauritius; Andaman, etc.).



1. 2.

Showing relative position of nostril in
1. *P. inunguis.* 2. *P. madagascariensis.*
(After Rendahl)

Key to the Species

I. Subcaudals subequal, the median series not strongly transversely enlarged

A. Centre of nostril immediately above the *suture* between first labial and rostral (see fig. 1).

1. Ventral scales smooth.

Upper labials 8; lower labials 7; preano-femoral pores in males 12; range: Rodriguez Island, near Mauritius ..... *newtoni* (p. 446)

Upper labials 8–10; lower labials 6–8; preano-femoral pores in males 14–25; range: Réunion Island and Mauritius *inunguis* (p. 448)

Upper labials 11–14; lower labials 9–10; preano-femoral pores in males 45–46; range: Round Island, near Mauritius..... *guentheri* (p. 449)

2. Ventral scales keeled.

Said to agree with *inunguis* (= *cepediana*) in all other respects except that dorsally the caudal verticils are composed of 7 (instead of 8–11) scales; range: said to have come from Madagascar..... *trilineata* (p. 450)

[1] Boulenger (1885d, p. 214) records two young geckos from Quilimane, Mozambique as "probably introduced"; received from Sir John Kirk.

B. Centre of nostril immediately above the first labial (see fig. 2).

1. Ventral scales keeled, even though feebly.

a. Dorsal, or at least lumbar, granules keeled, even though indistinctly.

A dark lateral line but no oval patch or ocelli in dorsolateral region; range: eastern Madagascar ..... *lineata* (p. 451)

A large vertically oval black patch above and behind fore limb only; range: eastern Madagascar ..... *bimaculata*[1] (p. 453)

A large ocellus behind fore limb and another before hind limb; range: southcentral Madagascar ..... *quadriocellata* (p. 454)

b. Dorsal *and* lumbar granules entirely smooth.

An orange-brown vertebral line flanked by a series of large orange-brown blotches; range: Seychelle Islands ... *astriata* (p. 455)

2. Ventral scales smooth.

a. Posterior chin shields and lateral chest scales weakly keeled.

Dark green dorsal coloring merges on flanks into whitish belly without marmorations; size large—93 mm. from snout to anus; range: Praslin Island, Seychelle Islands *sundbergi*[2] (p. 456)

b. Posterior chin shields and lateral chest scales as smooth as the ventrals.

i. Rostral with median cleft above.

(a) Dorsal granules entirely smooth.[3]

Dorsal pattern of dark longitudinal lines; inter-supranasal granules 1; upper labials 6–9; lower labials 6; range: eastern Madagascar ..... *barbouri* sp. n. (p. 457)

Dorsal pattern of dark cross bars; inter-supranasal granules 2; upper labials 9; lower labials 7; range: southwestern Madagascar ..... *standingi* (p. 459)

(b). Dorsal granules obtusely keeled.[3]

Dorsal pattern, if any, of small orange-brown spots;

[1] Occurs with *lineata* from which it is possibly not distinct (Mertens), though more probably a synonym of *quadriocellata*, as suggested by Rendahl.

[2] As nothing is said of the condition of the subcaudals, their subequal condition is assumed, should they be transversely enlarged then *sundbergi* will become a race of *madagascariensis*.

[3] Much care should be used in deciding.

inter-supranasal granules 2–3, rarely 1; upper labials 9–11; lower labials 8–10; range: northwestern Madagascar; Comoro Islands; Zanzibar and adjacent coast of Tanganyika Territory ..... *d. dubia* (p. 460)

ii. Rostral without median cleft above.

Dorsal and ventral coloring usually sharply separated by a dark lateral line or lines; chin as far back as third lower labial covered with shields of which the outer are much larger than the inner; range: Grand Comoro Island (? above 3000 feet) ..... *d. comorensis* (p. 463)

Dorsal and ventral coloring intermingling on flank; chin as far back as the third lower labial covered with tile-like shields of which the outer are scarcely larger than the inner; range: Comoro Islands ..... *v-nigra* (p. 464)

II. Subcaudals with median series strongly transversely enlarged.

A. Snout 1.6 to 2 times as long as the distance between eye and ear-opening.

Back dark olive slate or brown, uniform or a narrow vertebral line flanked by purple streaks; range: Aldabra Islands ..... *m. abbotti* (p. 465)

Back green, uniform or spotted with reddish orange; range: Andaman Islands ..... *m. andamanensis* (p. 467)

Back green or purplish, a reddish orange vertebral line flanked by reddish orange blotches; range: Seychelle and Amirante Islands *m. longinsulae* (p. 466)

Back bluish gray or slate, uniform or finely vermiculate with black; range: Pemba Island ..... *m. parkeri* (p. 468)

Back bluish gray or purplish, uniform or spotted with reddish orange, such spotting often confined to lumbar region; range: Madagascar and adjacent islands ..... *m. madagascariensis* (p. 470)

B. Snout 1.3 to 1.6 times as long as the distance between eye and ear-opening.

1. Transverse lamellae + transverse shields beneath fourth toe 16–18; males with 24–26 (28 *fide* Boulenger) preano-femoral pores; lower labials 6–9.

Upper labials 6–9; outer row of enlarged chin shields bordered internally by smaller ones passing gradually into gular granules; tail much spotted; range: western Madagascar and

adjacent islands (Nosy Be; Nosy Faly), Comoro Islands (Anjouan; Mayotte) and Farquhar. . . . . *laticauda* (p. 472)

Upper labials 8–11; 6–10 enlarged chin shields surround a group of small scales; gular chevrons extend as parallel lines to side of neck; range: northeastern Madagascar. . . . *guttata* (p. 474)

2. Transverse lamellae + transverse shields beneath fourth toe 10–12; males with 27–32 preano-femoral pores; lower labials 5–6.

Outer row of chin shields (consisting of 3–4 pairs) bordered posteriorly by smaller ones passing gradually into gular granules; range: Madagascar (chiefly southwest and south but recently recorded from the northeast). . . . . *mutabilis* (p. 475)

Outer row of chin shields (consisting of only 2 pairs) bordered posteriorly and abruptly by minute granules (possibly not distinct from *mutabilis* or records confused); range: southern Madagascar. . . . . *breviceps* (p. 477)

Phelsuma newtonii Boulenger

1884c. *Phelsuma newtonii* Boulenger, Proc. Zool. Soc. London, p. 2: Rodriguez Island, near Mauritius.
1885d. Boulenger, p. 212, pl. xvii.
1917g. Chabanaud, p. 442.

Description. Snout 1.6 times as long as the distance between the eye and the ear-opening, vertical diameter of the latter less than half that of the former; rostral with median cleft above; centre of nostril above the suture between rostral and first labial; the uppermost nasal separated from its fellow by 3 granules; upper labials 8; lower labials 7; only an inner pair of chin shields well differentiated from the gulars.

Back covered with smooth granules; ventral scales smooth; males with 12 preano-femoral pores forming an uninterrupted series; tail, when unregenerate, covered above with smooth scales, below with smooth, imbricate, subuniform scales.

Coloration. Above, blackish olive. Below, bluish gray; lips and throat sometimes whitish.

Measurements. Total length of cotype ♂, 223 (105 + 118) mm.

Remarks. No examples seen as known only from the two cotype males in the British Museum and a pair in the Paris Museum. The digits are said to be shorter than in other species.

Range. Rodriguez Island, near Mauritius.

[1]*Statistical Synopsis of Variation in the Genus Phelsuma*

SPECIES	Centre of nostril above (1) rostro-labial suture (2) labial	Nostril between first labial and . . .	Number of inter-supra-nasal granules	Upper labial range of . . .	Lower labial range of . . .	Lamellae beneath fourth toe	Range of preano-femoral pores in males
newtoni	suture	rostral + 3 nasals	3	8	7		12
*inunguis**	"	"	2–3	8–10	6–8	17–18	14–25
guentheri	"	"		11–14	9–10		45–46
trilineata	"	"					
*lineata**	labial	3 nasals	1–2	7–10	6–8	15–19	24–30
bimaculata	"	" only	1	8–9	7–9		27
*quadriocellata**	"	"	1–2	9–10	7–9	16–17	27–29
*astriata**	"	"	1–2–3	8–11	7–8	15–17	27–30
sundbergi	"	"	1–2–3	8–11	6–9		27–36
barbouri sp. n.*	"	"	1	6–9	6	16	?
standingi	"	"	2	9	7		?
*d. dubia**	"	" [2]2	1–2–3	9–12	8–10	15–17	22–29
*d. comorensis**	"	"	1	7–9	6–8	15–16	12–17
*v-nigra**	"	"	1	7–8	6–8	15–19	20–28
*m. abbotti**	"	"	1–2–3	7–8	7–7	18	33–34
*m. andamanensis**	"	"	2–3	8–11	6–10	15–16	24–32
*m. longinsulae**	"	"	1–2–3	9–11	7–9	17–18	28–35
*m. parkeri**	"	"	1 (2)	8–10	7–9	16–17	32–38
*m. madagascariensis**	"	"	1	7–10	6–9	16–19	34–50
*laticauda**	"	"	1	6–9	6–9	16–18	20–28
guttata	"	"	2	8–11	6–9		
*mutabilis**	"	2–3 nasals	1–2–3	6–8	5–6	10–12	27–32
*breviceps**	"	2 nasals	1	6–7	5–6	11	27–31

[1] Naturally many of these ranges will be extended when more material is available of those species of which only one or two examples are known at the present time.

[2] Two in a Bagamoyo lizard only.

* Represented in the collections of the Museum of Comparative Zoölogy, examples of those species without asterisk are earnestly desired.

PHELSUMA INUNGUIS (Cuvier)

1817. *Gecko inunguis* Cuvier, Régne Animal, ed. 1, **2**, p. 46, pl. v, fig. 3: Isle de France, i.e. Mauritius.
1817. Gecko cépédien (Peron) Cuvier, Régne Animal, ed. 1, **2**, p. 46, pl. v, fig. 5: Isle de France.
1820. *Gecko cepedianus* Merrem, Vers. Syst. Amphibien, p. 43: Mauritius.
1825. *Phelsuma crepidanus* (*sic*) Gray, p. 199.
1827. *Phelsuma ornatum* Gray, in King, Narrative Survey inter. west. Coasts Australia . . . 1818 and 1822, App., p. 428: Mauritius.
1831b. Gray, p. 48.
1831b. *Phelsuma Inunguis* Gray, p. 47.
1831b. *Phelsuma Cepedianus* Gray, p. 47.
1845. Gray, p. 166.
1833. *Platydactylus cepedianus* Geoffroy, Cl. III, pl. iii.
1836. Duméril & Bibron, p. 301, pl. xxviii, fig. 2.
1843. *Anoplopus cepedeanus* Fitzinger, p. 99.
1877b. *Pachydactylus cepedianus* Peters (part), p. 455.
1881c. Boettger (part), p. 530.
1885d. *Phelsuma cepedianum* Boulenger, p. 211.
1885c. Müller (part), p. 296.
1887. Strauch (part), p. 17.
1890a. Müller, p. 290.
1909. Mocquard, pp. 19, 96.
1939a. Rendahl, p. 265, fig. 2a.

Further citations of '*cepedianus*' will be found under *guentheri, barbouri, d. dubia, m. longinsulae, m. madagascariensis,* and *laticauda.* Rochebrune's (1884a, Faune de la Senegambie. Reptiles, p. 74) record from Senegambia is ignored. Duméril and Bibron's synonymy is misleading as they have latinized many vernacular citations until they bear little resemblance to the original.

Description. Snout 1.7 to 2 times as long as the distance between the eye and the ear-opening, vertical diameter of the latter [1]seven-eighths that of the former; rostral with median cleft above; centre of nostril above the suture between rostral and first labial; nostril between rostral (sometimes barely), first labial (sometimes excluded) and 3 nasals, the uppermost separated from its fellow by 2–3 granules; upper labials 8–10; lower labials 6–8; chin region covered with enlarged scales of which the outer are larger than the inner, the latter posteriorly merging into the gulars.

Back covered with smooth granules; ventral scales smooth; males with 14–25 preano-femoral pores forming an uninterrupted series;

[1] Half *fide* Boulenger (1885d).

about 17–18 transverse lamellae beneath fourth toe anteriorly; tail, when unregenerate, covered above with smooth scales, below with smooth imbricate scales, subuniform, or the two median series somewhat enlarged.

Coloration. Above, bluish or purplish with reddish markings, viz. a variously-shaped interocular mark, snout with, or without, a ∩-shaped band whose arms extend to the eyes and may continue on to the shoulder or even along the flanks, occiput and nape with two or three longitudinal stripes, back and tail irregularly spotted. Below, whitish, the throat sometimes grayish but not spotted.

Measurements. Total length of ♂, 151 (68 + 83) mm., from Reunion Island (M.C.Z. 2165).

Remarks. Gecko inunguis was placed with a query in the synonymy of *Pachydactylus ocellatus* by Boulenger, a name usually applied to a South African gecko now known as *P. geitje* (Sparrmann, 1778). It seems to me, however, from Cuvier's figure and locality that it was the poreless female of the male lizard which he called cépédien, a name given to it in Peron's manuscript. Under any circumstances Cuvier is not the author for cépédien was first latinized by Merrem. The question of specific identity as between *inunguis* and *cepediana* can be settled only by a careful examination of the types in the Paris Museum, bearing in mind the extreme variability in pattern, particularly as between young and old of this Mauritian gecko.

Habits. Peters (part, 1877b) states that these geckos occur in forests and gardens where their hard-shelled eggs may be found adhering to leaves. He attributes to them a uniformly high, not unpleasant note which may be heard in the evening and at night. Both statements require verification for most geckos select a more stable foundation—such as crevices in a tree trunk—to which to attach their eggs.

Range. Mauritius and Réunion Islands (Formerly known as Iles des France et Bourbon).

Phelsuma guentheri Boulenger

1873. *Platydactylus cepediana* Pike (not Merrem), p. 161.
1885c. *Phelsuma cepedianum* Müller (part), p. 296 ("Mauritius").
1885d. *Phelsuma guentheri* Boulenger, Cat. Lizards Brit. Mus., **1**, p. 213: Round Island, near Mauritius
1887. Strauch, p. 17.
1890a. Müller, p. 289.

Description. Snout nearly 2 times as long as the distance between the eye and the ear-opening, vertical diameter of the latter about a

third that of the former; rostral with median cleft above; centre of nostril above the suture between rostral and first labial; upper labials 11–14; lower labials 9–10; chin region covered with enlarged scales of which the outer are slightly smaller than the inner, and well differentiated from the minute gulars.

Back covered with smooth granules; ventral scales smooth; males with 45–46 preano-femoral pores forming an uninterrupted series; tail, when unregenerate, covered above with smooth scales, below with smooth, imbricate, subuniform scales.

Coloration. Above, gray, uniform (♀), or head sparsely spotted with black (♂) and with two subparallel black streaks from eye towards neck where they may terminate or continue on across nape to unite with their fellows from the other side to form two chevron-like markings. Below, whitish, throat marked with gray (Strauch).

Measurements. Total length of a cotype, 223 (125 + 98) mm., but surpassed by a ♂, with a total length of 240 mm. (Strauch).

Remarks. Below I give verbatim Pike's description of this lizard as contained in the chapter dealing with his first visit to the almost inaccessible Round Island which concludes with the statement: "I believe this lizard is as yet undescribed." Apparently these notes deal with the types listed by Boulenger as received from Günther. The last sentence of paragraph 3 in Pike's account would appear to have been added at a later date to his journal-account, perhaps on hearing from Günther, but this is purely speculative, it reads: "The lizard is the same as the one so common in Mauritius (*Platydactylus cepedianus*)," and should apparently have been added to the previous paragraph.

Habits. "An active little creature found in the steep rocks on the mountain side. It is about 6″ in length and deposits from 6 to 12 white eggs, the size of an ounce musket ball, in a row on the branches of the *Latania glaucophylla*, which are so firmly glued to the bark that they could not be detached without breaking." (Pike). That all the eggs were laid by one gecko is, of course, a mistake.

Range. Round Island, about 25 miles from Mauritius.[1]

Phelsuma trilineata Gray

1842. *Phelsuma trilineatum* Gray, Zool. Misc., p. 57: No locality given, later stated by Boulenger to be Madagascar.
1885d. Boulenger, p. 212.
1909. Mocquard, pp. 19, 93.
1845. *Phelsuma lineatum* Gray (part), p. 166.

[1] Müller and Strauch's four specimens are labeled Mauritius only, and may be misidentified *inunguis*.

Description. Ventrals keeled, though less strongly than in *lineata*, while dorsally a caudal verticil consists of 7 scales. Otherwise, according to Boulenger, it agrees with *cepediana* (i.e. *inunguis*) in every respect. Known only from the type, allegedly from Madagascar, and a second specimen which is without locality, both in the British Museum, and neither of which I have seen.

Coloration. Above, olive black; forehead with a triangular orange spot; a broad streak from nostril through ear to fore limb; three narrow lines and two rows of oblong orange spots. (Gray).

Range. Said to be Madagascar.

Phelsuma lineata Gray

1842. *Phelsuma lineatum*[1] Gray, Zool. Misc., p. 57: Madagascar.
1845. Gray, p. 166.
1885d. Boulenger, p. 216.
1885a. Müller, p. 163.
1887a. Boulenger, p. 490.
1887. Strauch, p. 18.
1893a. Boettger, p. 39.
1901. Schenkel, p. 182.
1901b. Tornier (part), p. 64.
1903b. Ferreira, p. 22.
1909. Mocquard, pp. 20, 92, 93.
1913. Boettger (as *Phelsumia*), pp, 294, 322, 328.
1913a. Methuen & Hewitt, p. 187.
1918. Barbour, p. 482.
1922. Kaudern, p. 420.
1925b. Angel, p. 60.
1931d. Angel, p. 515.
1933b. Mertens (part), p. 265.
1934a. Angel, p. 312.
1939a. Rendahl, p. 270.
1880a. *Pachydactylus laticauda* Boettger (part), p. 280 (Tamatave only).
1881c. Boettger (part), pp. 461, 530 (Tamatave only).
1881c. *Pachydactylus lineatus* Boettger, p. 530.
1893a. *Phelsuma laticauda* Boettger (part), p. 39 (Tamatave only).
1918. Barbour, p. 482.
1913. *Phelsumia lineata* var. *bifasciata* Boettger, in Voeltzkow, Reise in Ostafrika, **3**, p. 294: Ankarimbela, i.e. Ankarimbola, southcentral Madagascar.
1936c. ?*Phelsuma dubium* Angel[2] (? not Boettger), p. 126 (Tsianovoka).

[1] Some of the references following are to *lineatus* and *lineata*.

[2] Based on a young gecko; tentatively placed here as being the only record of *dubia* from the east coast, whereas *P. lineata* has been recorded from Anovoka by Boettger (1913).

Further citations of '*lineata*' will be found under *trilineata, carinata,* and *bimaculata.*

Description. Snout 1.3 to 1.6 times as long as the distance between the eye and the ear-opening, vertical diameter of the latter about half that of the former; rostral without, rarely with, a median cleft above; centre of nostril above first labial; nostril between first labial and 3 nasals, the uppermost separated from its fellow by 1–2 granules; upper labials 7–10; lower labials 6–8; chin region covered with enlarged scales of which the outer are slightly larger than the inner, the latter posteriorly merging into the gulars.

Back covered with strongly, or obtusely, keeled granules; ventral scales keeled, though often very feebly; males with 24–30 preanofemoral pores forming an uninterrupted series; about 15–19 transverse lamellae beneath fourth toe anteriorly; tail, when unregenerate, covered above with keeled scales, below with keeled, imbricate, subuniform scales.

Coloration. Above, brownish or purplish; snout sometimes with a dark, trident-like marking; a dark streak from nostril through eye and ear along flank and tail, sharply defining the dorsal coloring from the ventral; back blotched or variegated with lighter posteriorly; limbs and tail marbled with black. Below, whitish; a dusky violet ∩-shaped mark following contour of lower jaw to insertion of forearm, sometimes extending on along the flank, thereby separating a light lateral line (*bimaculata*), to hind limb; tail immaculate or flecked with darker.

Measurements. Total length of ♂, 105 (53 + 52) mm., from Madagascar (U.S.N.M. 23427), and of ♀, 108 (52 + 56) mm., from between Tamatave and Tananarivo (M.C.Z. 11719).

Remarks. Boettger (1881c) assigned to the synonymy Duméril & Bibron's (1836, p.298) *Pachydactylus ocellatus* on account of their statement as to its probable occurrence in Mauritius, though a reëxamination of the type of *Gecko ocellatus* may yet demonstrate it to be a *Phelsuma* it will not be found referable to *lineata.*

Boulenger (1887a), after examination of the types, referred *quadriocellata* to the synonymy of *lineata.* Though it must be confessed that the lepidosis is closely similar I am confident that they are distinct, perhaps, as suggested by Mertens (1933b), subspecifically, but no definite locality has yet been recorded for *quadriocellata.*

Boettger (1913) separated *bifasciata,* of which the Museum of Comparative Zoölogy has a cotype (M.C.Z. 21950), on the grounds that

it usually has 2 granules between the anterior nasals whereas *lineata* usually has 1, yet Boettger later says that of the 11 cotypes which he has examined 6 have 2 granules and 5 have only 1! The only other differences cited are the allegedly less well defined caudal verticils, a character which appears variable in most species of the genus, and the presence of a second longitudinal stripe on the flank. Yet in our cotype the stripe does not extend behind the fore arm and appears to be represented in varying degrees of indistinctness in our extensive material from other localities.

Localities. **Madagascar:** Alaotra; Ambatondrazonaka; Ambila; Ambilo; Ambinany (? Eminiminy); Anamalozotra; Ankarimbola (Ankarimbela); Anovoka (Anevoka; Tsianovoka); Antsihanaka; Betampona Reserve; (Eminiminy, see Ambinany); Didy Swamps; Fandrarazana; Fenerive; Fianarantsoa; Ile aux Prunes; Ivoloina;-(Majunga[1]); Sakana; Ste. Marie Id. Tamatave; Tamatave to Tanan arivo; Tampina.

Mertens (1933b) record from Col Pierre Radama is removed to *bimaculata* until the status of that form is definitely settled.

Range. Eastern[1] Madagascar.

Phelsuma bimaculata Kaudern

1922. *Phelsuma bimaculata* Kaudern, Zool. Jahrb. Syst., **45**, p. 420, pl. xii, fig. 2: Fandrarazana, eastern Madagascar.
1939a. Rendahl, p. 270.
1933b. *Phelsuma lineata* Mertens (part), p. 265.

Description. Snout (1.6 to) 2 times as long as the distance between the eye and the ear-opening, vertical diameter of the latter about half that of the former; rostral with, rarely without, median cleft above; centre of nostril above first labial; the uppermost nasal separated from its fellow by 1 granule; upper labials 8–9 (11); lower labials (6) 7–9. Back covered with slightly keeled granules; ventral scales strongly keeled; males with 27 (24–28) preano-femoral pores forming an uninterrupted series; tail, when unregenerate, covered above with keeled scales.

Coloration. Above, bluish or reddish violet flecked with golden yellow; above and behind fore limb is a large, vertically oval black blotch (but no lateral line as is found in *lineata);* limbs slightly mottled; tail punctate with black dorsally and with an indistinct, longitudinal,

[1] Boettger's (1893a, 1913) record of Majunga, being the only one from the northwest should be received with reserve, the possibility of erroneous locality data not being overlooked.

black line laterally. Below, whitish, a dusky violet ∩-shaped mark following contour of lower jaw to insertion of fore limb; tail immaculate.

Rendahl (1939a) says that Kaudern overlooked a faint second blotch anterior to hind limb in the types. Kaudern is mistaken in thinking that the underside of the tail in all *lineata* are punctate, some of our numerous specimens have tails which are immaculate beneath.

Measurements. Total length of cotype ♂, 85 (43.5 + 42.5) mm., of cotype ♀, 89 (43.5 + 45.5) mm., but tails of both partly or wholly regenerated.

Remarks. Mertens (1933b), who had nine geckos from Col Pierre Radama which agreed with the figure and description of *bimaculata*, is inclined to think that it is but a color variant of *lineata* for the latter species was taken in the same locality. Kaudern also referred to *lineata* six geckos which he took at Fandrarazana, the type locality of *bimaculata*.

Rendahl (1939a) compared the types of *bimaculata* with six geckos, taken in southeast Madagascar between the tableland and coast, and declared them to be the same though his specimens exhibited four blotches as in *quadriocellata*, a species with which he thought *bimaculata* might prove to be synonymous, a conclusion which is probably correct. In view, however, of the possibility that they are subspecifically distinct, and that his material from the southeast should rather be referred to *quadriocellata* of southcentral Madagascar than to *bimaculata* of northeastern Madagascar, any *additional* data derived from Rendahl's six specimens is incorporated in the above description in parentheses.

Localities. **Madagascar:** Col. Pierre Radama; Fandrarazana.

Range. Eastern Madagascar.

Phelsuma quadriocellata (Peters)

1883b. *Pachydactylus quadriocellatus* Peters, Sitz. Ges. Naturf. Freunde Berlin, p. 28: Madagascar.

1885d. *Phelsuma quadriocellatus* Boulenger, p. 216.

1909. *Phelsuma quadriocellatum* Mocquard, pp. 20, 98.

Description. Snout 1.5 times as long as the distance between the eye and the ear-opening, vertical diameter of the latter about half that of the former; rostral without median cleft above; centre of nostril above first labial; nostril between first labial and 3 nasals, the uppermost separated from its fellow by 1–2 granules; upper labials 9–10; lower labials 7–9; chin region covered with enlarged scales of which the

outer are but slightly larger than the inner, the latter posteriorly merging into the gulars.

Back covered with almost smooth granules; ventral scales keeled; males with 27–29 preano-femoral pores forming an uninterrupted series; about 16–17 transverse lamellae beneath fourth toe anteriorly; tail, when unregenerate, covered above with smooth scales, below with smooth (distally) and keeled (basically) imbricate, subuniform scales.

Coloration. Above, emerald green, more or less uniform or flecked with darker; head and neck spotted with pale blue; behind the fore limb is a black spot edged with pale blue, a similar spot in front of the hind limb; on the flanks the dorsal pigmentation darkens along its lower edge (as in *lineata*). Below, whitish (yellowish), a dusky violet ∩-shaped mark following contour of lower jaw to insertion of fore limb, sometimes extending on along the flank to hind limb. Iris golden yellow.

Measurements. Total length of ♂, 88 (42 + 46) mm.; of ♀, 80 (38 + 42) mm. (M.C.Z. 7734).

Remarks. Despite its close relationship to *lineata* and the probability that the ocelli are derived from a dark lateral line, I cannot help but think, from examination of the pair in the Museum of Comparative Zoölogy, that this rare lizard is distinct; possibly, as suggested by Mertens (1933b), it may ultimately prove to be a geographical form when we know something of its distribution.

Range. Central Madagascar.

Phelsuma astriata Tornier

1901b. *Phelsuma lineata* var. *astriata*, Tornier, Zool. Anz., **24**, p. 65: Mahe Island, Seychelle Islands.

1939a. *Phelsuma carinatum* Rendahl, Zool. Jahrb. Syst., **72**, p. 277: Praslin Island, Seychelle Islands.

1939a. *Phelsuma carinatum maheense* Rendahl, Zool. Jahrb. Syst., **72**, p. 278: Port Victoria, Mahe Island, Seychelle Islands.

Description. Snout 1.8 to 2.1 times as long as the distance between the eye and the ear-opening, vertical diameter of the latter about half that of the former; rostral with median cleft above; centre of nostril above first labial; nostril between first labial and 3 nasals, the uppermost separated from its fellow by 1–3 granules; upper labials 8–11; lower labials 7–8; chin region covered with enlarged scales of which the outer are larger than the inner, the latter posteriorly merging into the gulars.

Back covered with smooth granules; ventral scales keeled; males with 27–30 preano-femoral pores forming an uninterrupted series; about 15–17 transverse lamellae beneath fourth toe anteriorly; tail, when unregenerate, covered with smooth scales, below with keeled, imbricate, subuniform scales (in reproduced tails sometimes transversley enlarged, sometimes not).

Coloration. Above, blue violet; a brownish-orange streak from nostril to eye; a ∩-shaped mark in frontal region; back with a vertebral line (sometimes broken up) flanked by more or less coalescing spots; flanks with another series; limbs variegated with lighter; tail spotted or cross-barred with lighter. Below, whitish, a dusky violet ∩-shaped mark following contour of lower jaw; breast, belly, and tail immaculate.

The coloring closely resembles that of *P. m. longinsulae*, also of the Seychelles. It is interesting to note that Rendahl says of *carinatum* that the coloring resembles that of *sundbergi* but vertebral stripe is darker and the red markings larger, while of *mahcense* he remarks that it resembles *carinatum* except for the more distinct gray vertebral stripe.

Measurements. Total length of ♂, 123 (57+66) mm. (M.C.Z. 46146), largest cotype of *carinatum* 56 mm. from snout to vent; of *mahcense* 55.5 mm.; tails of both being damaged.

Remarks. No characters or key for distinguishing *carinatum* and *mahcense* are furnished by Rendahl who apparently overlooked Tornier's *astriata*, buried in the text under the heading *Phelsuma lineata*.

Localities. **Seychelle Islands:** Bel Air, near Port Victoria, Mahe Id.; Praslin Id.

Range. Seychelle Islands.

Phelsuma sundbergi Rendahl

1939a. *Phelsuma sundbergi* Rendahl, Zool. Jahrb. Syst., **72**, pp. 274, 318, figs. 3–5, 16: Praslin Island, Seychelle Islands.

Description. Snout about 2.1 times as long as the distance between the eye and the ear-opening; rostral with median cleft above; centre of nostril above first labial; nostril between first labial and 3 nasals, the uppermost separated from its fellow by 1–3 granules; upper labials 8–11; lower labials 6–9. Posterior chin shields and lateral scales of chest weakly keeled; ventral scales smooth; males with 27–36 preano-femoral pores forming an uninterrupted series.

Coloration. Above, dark green (almost emerald green in life); a reddish streak from nostril to eye present or absent; a ∩-shaped mark on frontal region; on flanks the dark dorsal coloring merges into the lighter coloring of the belly without marmorations; limbs uniform (weakly marbled in life). Below, whitish; a dusky ∩-shaped mark following contour of lower jaw present or absent; throat of young uniform or shaded with gray, of adults with dusky flecking. Tongue red.

Measurements. Total length of largest cotype, 178 (93.5+84.5) mm.

Remarks. As nothing is said about the subcaudal arrangement, the present action in placing *sundbergi* in the group of those having subuniform subcaudals is arbitrary and based on Rendahl's action in placing it before "*carinatum.*" Should the subcaudals have the median series transversely enlarged, *sundbergi* will undoubtedly prove to be a race of *mascareniensis* (which has been recorded from Praslin Id. by other authors) possibly peculiar to Praslin where the keeling on posterior chin shields and breast may have developed as a secondary sexual character for one notes that no fewer than 17 of the 24 cotypes are males. Had it not been for Rendahl's mentioning young specimens in his color description I should have been tempted to suggest uniting *sundberg* with *longinsulae* (the former having page precedence) whose head markings it is said to resemble.

Diet. In captivity, flies, cockroaches, and mealworms (Rendahl).

Habits. In captivity these geckos were eager to take up drops of water with their tongues. Though diurnal, they avoided direct sunlight and sought out shady corners, preferring the glass sides of their vivarium to the twigs and branches which had been supplied them. Occasionally one male might be seen chasing another but at no time was any sound heard from them. As the sloughing period approached, the geckos' movements became perceptibly slower and a striking change from the normal bright green coloring to dusky blackish green took place. As the old skin loosened it was removed and eaten by the gecko. After a year in captivity a skin disease made its appearance among them, it was characterized by black spots and wasting of the tail, which would finally fall off. Assuming it to be a deficiency disease, Vigantol on sugar was supplied with some success, for the last geckos to succomb were not victims of the disease.

Range. Praslin Island, Seychelle Islands.

PHELSUMA BARBOURI spec. nov.

1918. *Phelsuma cepedianum* Barbour (not Merrem), p. 482.

Type. Museum of Comparative Zoölogy, No. 11640, a ♀ from forest between Tamatave and Tananarivo, eastern Madagascar, collected by F. R. Wulsin, 1915.

Paratypes. Museum of Comparative Zoölogy, No. 11641, a younger ♀ with same data as type; also American Museum of Natural History, No. 47897, an adult ♀ from Madagascar (precise locality label disintegrated by preservative), collected by the Archbold Franco-Anglo-American Expedition of 1929–1931.

Diagnosis. Closely related to *standingi* Methuen & Hewitt, of southwestern Madagascar, from which it differs in those characters indicated in the Key (p. 444) and to which it may be subspecifically related but the males of neither species are known.

Description. Snout 1.3 to 1.5 times as long as the distance between the eye and the ear-opening, vertical diameter of the latter about three-quarters that of the former; rostral with median cleft above; centre of nostril above first labial; nostril between first labial and 3 nasals, the uppermost separated from its fellow by 1 granule; upper labials 6–9; lower labials 6; anterior pair of chin shields much larger than those immediately behind, the latter posteriorly merging into the gulars.

Back covered with smooth granules; ventral scales smooth; (male unknown); about 16 transverse lamellae beneath fourth toe anteriorly; tail, when unregenerate, covered above with smooth scales, below with smooth, imbricate, subuniform scales.

Coloration. Above, brownish olive; a dark brown streak from nostril through eye and ear-opening to flank anteriorly; another streak from supraocular region continuing as a dorsolateral line to about midbody where it breaks up or continues indistinctly to base of tail; two brown streaks from snout to occiput where they coalesce to form a single line on nape only to break up into a series of dashes posteriorly, in fact on the dorsum there is a tendency for all these lines to disintegrate and form vermiculations; limbs almost uniform; tail uniform. Below, uniformly bluish gray except for an obsolescent, dusky, ∩-shaped mark following contour of lower jaw.

Measurements. Total length of type ♀, 99 + (59 + 40 +) mm., the tip being regenerated, surpassed in length from snout to anus by a paratype ♀ (A.M.N.H. 47897) of 64 mm.

Remarks. At the time these two specimens were received the genus

was but poorly represented in the collection of the Museum of Comparative Zoölogy with less than half the forms we have today.

Phelsuma standingi Methuen & Hewitt

1913a. *Phelsuma standingi* Methuen & Hewitt, Ann. Transvaal Mus. **3**, p., 187: Forest fringing Onilahy River at Maroamalona, southwestern Madagascar.

1939a. Rendahl, p. 268.

Description. Snout 1.5 times as long as the distance between the eye and the ear-opening; rostral with median cleft above; nostril between first labial and 3 nasals, the uppermost separated from its fellow by 2 granules; upper labials 9; lower labials 7; anterior pair of chin shields much larger than those immediately behind.

Back covered with smooth granules; ventral scales smooth; (male unknown); tail, when unregenerate, covered above with smooth scales, below with smooth, imbricate scales (of which the two median rows are enlarged, according to the authors).

Coloration. Above, emerald green, with numerous dark, irregular, transverse bars. Below, whitish, except for some bluish-gray flecking on throat; tail bluish.

Measurements. Total length of type ♀, 149+ (88 + 61+) mm., the tail being regenerated.

Remarks. Known to me only from the scanty description which should be augmented to the complete format furnished for other species. I am indebted to Mr. V. FitzSimons for confirming points in the description in which it differed from the preceding species.

Locality. **Madagascar:** Maroamalona.

Range. Southwestern Madagascar.

Phelsuma dubia dubia (Boettger)

1854. *Platydactylus cepedianus* Peters (not Merrem), p. 615.
1855. Peters, p. 44.
1887. Vaillant, p. 134.
1866b. *Pachydactylus cepedianus* Peters (not Merrem), p. 887.
1869a. Peters (part), p. 13 (omit Nosy Be and Seychelles).
1882a. Peters (part), p. 27.
1881a. *Pachydactylus dubius* Boettger, Zool, Anz., **4**, p. 46: Madagascar.
1881c. Boettger, pp. 464, 530.
1881g. Boettger, p. 179.
1885d. *Phelsuma madagascariense* Boulenger (part), p. 214 (Zungomero).
1885d. *Phelsuma dubius*[1] Boulenger, p. 215 (no material).
1893a. Boettger, p. 38.
1894e. Boulenger, p. 723.
1902b. Tornier, p. 581.
1909. Mocquard, pp. 20, 89.
1913. Boettger[2], pp. 292, 327, 336, 339, 341, 343, pl. xxix, figs. 7–10.
1913c. Nieden, p. 68.
1917. Voeltzkow, p. 460.
1922a. Mertens, p. 183.
1931d. Angel, p. 515.
1939a. Rendahl, p. 268.
1940. Parker, Moreau & Pakenham, p. 309.
1941. Moreau & Pakenham, 1940, p. 107.
1900b. *Phelsuma laticauda* Tornier (not Boettger), p. 588.
1913a. Methuen & Hewitt, p. 187.
1920a. Loveridge, p. 139.
1923d. Loveridge, p. 846.
1924b. Loveridge, p. 9.
1925a. Loveridge, p. 72.
1928c. Barbour & Loveridge, p. 146.
1933h. Loveridge, p. 295.
1937f. Loveridge, p. 492.
1903b. *Phelsuma cepedianum* Ferreira (not Merrem), p. 21.
1917. Voeltzkow, p. 459.

Further citations of '*dubia*' will be found under *lineata* and *laticauda*.

Native name. *Camantindi* (Anjouan Id.: Peters).

Description. Snout 1.3 to 1.6 times as long as the distance between the eye and the ear-opening; vertical diameter of the latter about three-quarters that of the former; rostral with[3] median cleft above; centre of nostril above first labial; nostril between first labial and 2-3

[1] Some of the references following are to *dubium* and *dubia*.
[2] As *Phelsumia* (1913 only).
[3] Dar es Salaam specimens allegedly without, not available for reexamination.

nasals[1], the uppermost separated from its fellow by 2-3, *very rarely* 1, granules; upper labials 9–12; lower labials 8–10; chin region covered with enlarged scales of which the outer are much larger than the inner, the latter posteriorly merging into the gulars.

Back covered with obtusely keeled[2] granules; ventral scales smooth; males with 19–29[3] preano-femoral pores forming an uninterrupted series; about 15–17 transverse lamellae beneath fourth toe anteriorly; tail, when unregenerate, covered above with obtusely keeled scales, below with smooth, imbricate, subuniform scales.

Coloration. Above, bluish gray to purplish brown, variegated and spotted with orange brown; on flank a dusky streak is present or absent; limbs vermiculated or spotted with black, gray, or bluish; tail sometimes bluish. Below, whitish, immaculate, or a dusky ∩-shaped mark following contour of lower jaw to shoulder.

In life (Dar es Salaam). Above, dark green, finely flecked with red on back and tail.

Judging by a hatchling (A.M.N.H. 147880), 21 mm. in length from snout to anus, the young are minutely speckled with brown-edged white spots which disappear by the time the gecko attains 23 or 24 mm. (A.M.N.H. 47881–2) in length.

From time to time Boettger has cited color differences allegedly distinguishing *dubia* from other species; these do not appear to hold good in series and should be accepted with reserve.

Measurements. Total length of ♂, 150 (65 + 85) mm., from Zanzibar (M.C.Z. 19123); and of ♀, 133 (58 + 75) mm., from Madagascar (Boettger, 1913).

Remarks. The type of *dubia* was not available to Boettger when he (1881c) identified a specimen, allegedly from Nosy Be, as *dubia.* Later (1913) he denied the occurrence of *dubia* on Nosy Be 'as formerly supposed' though I am not clear whether it was the determination or the locality data which was at fault. Nosy Be is, however, omitted from the list of localities below.

In the latter paper (1913, p. 337) he gives a very fair summary of the characters distinguishing *dubia* from *laticauda,* though in stating that the two species agree in not having the median series of subcaudals enlarged, he errs, for of course *laticauda* has. At some time Boettger appears to have confused the type which he originally stated was in the Hamburg Museum and later referred to as being in

[1] Two is rare, in one Bagamoyo (M. C. Z. 24084) gecko only.

[2] Smooth, in the original description, was subsequently corrected.

[3] 19–22 in Methuen & Hewitt's (1913a) series of "*laticauda,*" fide FitzSimons (1942, in letter) who says that "the reduction in pores has taken place distally, where there are 3–4 enlarged poreless scales continuous with those bearing pores."

the Senckenberg Museum (No. 4192.2a), which Mertens (1922a) refutes.

In referring Zanzibar geckos to *laticauda*, I (1920a, *et seq.*) was in error, having accepted Tornier's (1900b) conclusions and for several years overlooked his subsequent (1902b) retraction. Even then, in the hope that they might prove to be subspecifically related, I continued to use the name *laticauda* while awaiting an opportunity to revise the genus. Parker (1940) recently pointed out my error and now, after careful comparison of Zanzibar, Bagamoyo, and Dar es Salaam material with a series of *dubia* from Madagascar, I entirely fail to find any difference between then, beyond, perhaps an average in size.

Breeding. Presumably the pair of eggs are deposited in the crowns of coconut palms, for the lowest eggshells which I have found were at a height of six feet from the ground.

Diet. Ants and beetles.

Parasites. Red acarine parasites are sometimes present about anus.

Enemies. One was recovered from the stomach of a tiger snake (*Tarbophis s. semiannulatus*) at Bagamoyo.

Habitat. In East Africa, owing to its dwelling in the crowns of coconut palms, this gecko is exceedingly difficult to obtain. The first specimens which I secured were taken while passing through a street in the native quarter of Dar es Salaam. Overhead some thatchers were cutting fronds and dropping them into the road. Even then, one of the geckos made a dash for the nearby trunk of a palm which it ascended to safety. Occasionally one encounters these beautiful geckos on the ground, presumably *en route* from one palm to another.

In Madagascar, according to Boettger (1913), this species is found upon the satra palms, whereas *madagascariensis*, though inhabiting the same localities, dwells among the mangroves.

Localities. **Madagascar**[1]: Kandrany (Kandani); Majunga; Makamby Island; Maroamalona; St. Augustin; Soalala. **Comoro Islands:** Anjouan (Johanna) Id.; Grand Comoro Id.[2]; Mayotte Id.; Moheli Id. **Zanzibar Island, Tanganyika Territory:** Bagamoyo; Dar es Salaam; Singino; Zungomero.

Range. Northwest Madagascar[1]; Comoro Islands; Zanzibar Island; and adjacent coast of Tanganyika Territory.

[1] The only record from eastern Madagascar for *dubia* is that of Angel (1936c) for a young gecko from Anovoka (Tsianovoka). I have omitted this as questionable and as the point cannot be cleared up at the present time by an examination of the specimen in question, have tentatively referred the reference to *lineata*, a species which has been recorded from Anovoka by Boettger (1913).

[2] A possible explanation of the occurrence of both the typical form and the race *comorensis* on this island may be found that the latter is at present known only from above 3000 feet.

Phelsuma dubia comorensis Boettger

1913. *Phelsumia laticauda* var. *comorensis* Boettger, in Voeltzkow, Reise in Ostafrika, **3**, p. 336: La Grille, *circa* 1000 metres, Grand Comoro Island.
1917. Voeltzkow, p. 460.
1929d. Barbour & Loveridge, p. 314.
1939a. Rendahl, p. 269.

Description. Snout 1.5 to 1.6 times as long as the distance between the eye and the ear-opening, vertical diameter of the latter about three-quarters that of the former; rostral *without* median cleft above; centre of nostril above first labial; nostril between first labial and 3 nasals, the uppermost separated from its fellow by 1 granule (in all 23 cotypes); upper labials 7–9; lower labials 6–8; chin region covered with enlarged scales of which the outer are much larger than the inner, the latter posteriorly merging into the gulars.

Back covered with *smooth* granules; ventral scales smooth; males with 12–17[1] preano-femoral pores forming an uninterrupted series; about 15–16 transverse lamellae beneath fourth toe anteriorly; tail, when unregenerate, covered above with smooth scales, below with smooth, imbricate, subuniform scales.

Coloration. Above, olive green, greenish or violet gray; a light streak from nostril to eye; a ∩-shaped mark in frontal region; a semicircular patch on occiput, all three light markings showing a tendency to coalesce; back with, or without, a light, irregular, vertebral line (sometimes disintegrating) flanked posteriorly by a series of light irregular blotches which tend to coalesce; sometimes a broad, dark line along flank from eye to base of tail sharply defining the dorsal coloring from the ventral. Below, whitish, immaculate, or a dusky, violet ∩-shaped mark following contour of lower jaw to insertion of fore arm, sometimes extending on along the flank, thereby separating a light lateral line, to hind limb; tail immaculate or flecked with darker.

Measurements. Total length of cotype ♀, 85 + (50 + 35 +) mm. (M.C.Z. 21954).

Remarks. The above description is based solely on three female cotypes in the Museum of Comparative Zoölogy together with data culled from the original description of the twenty-three cotypes.

Boettger made *comorensis* a race of *laticauda* on account of its agreeing with that species in its rostral being without a median cleft

[1] Perhaps Boettger intended to qualify this by saying 'on either side,' in that event 24–34 would seem to be extremely high.

and the uppermost nasal being separated from its fellow by a single granule, he disregarded the more important character of its subuniform subcaudals as contrasted with those of *laticauda* in which those of the median series are transversely enlarged. To me its derivation from *dubia* seems obvious. We are, however, faced with the fact that both forms occur on Grand Comoro and can only speculate that while *dubia* is restricted to the lowlands, *comorensis* is a montane race.

Phelsuma v-nigra Boettger

1913. *Phelsumia v-nigra* Boettger, in Voeltzkow, Reise in Ostafrika, **3**, pp. 337, 339, 341, 343, pl. xxv, fig. 9: Moheli Island, Comoro Islands.
1917. Voeltzkow, p. 460.
1929d. Barbour & Loveridge, p. 314.
1939a. Rendahl, p. 267.

Description. Snout 1.5 to 1.6 times as long as the distance between the eye and the ear-opening, vertical diameter of the latter about half that of the former; rostral without median cleft above; centre of nostril above first labial; nostril between first labial and 3 nasals, the uppermost separated from its fellow by 1 granule; upper labials 7–8; lower labials 6–8; chin region covered with enlarged tile-like, flat scales of which the outer are slightly larger than the inner, the latter posteriorly merging into the gulars.

Back covered with smooth granules; ventral scales smooth; males with 20–28 preano-femoral pores forming an uninterrupted series; about 15–19 transverse lamellae beneath fourth toe anteriorly; tail, when unregenerate, covered above with smooth scales, below with smooth imbricate scales of which the two median series are irregularly and slightly enlarged.

Coloration. Above, purplish brown (blue green in life), uniform or flecked with lighter gray green or gray brown, head with from one to seven flecks; tail vermiculated with black. Below, whitish (citron yellow), a dusky ∩-shaped mark following contour of lower jaw; throat uniform or with a second dark, chevron-like mark.

Measurements. Total length of cotype ♂, 95 (45 + 50) mm. (A.M.N.H. 24772); of cotype ♀, 94+ (46 + 48+) mm., tail regenerating (M.C.Z. 17844); both from Moheli Island, which, it may be noted, is the type locality, *not* Grand Comoro Island.

Remarks. In scale counts indistinguishable from *P. d. comorensis* of La Grille Mountain, Grand Comoro, but very different in chin shields and coloration. In the latter character it reveals affinities

with *P. m. abbotti* of Aldabra Island, displaying the dusky gular chevron so frequently present in members of the *madagascariensis* group, though it differs from them in having the two median rows of subcaudals subequal or but slightly enlarged. Boettger observes that the chin shields of *r-nigra* are more numerous than in *madagascariensis*.

Localities. **Comoro Islands:** Anjouan (Johanna) Id.; Mayotte Id.; Moheli Id.; and Mt. Msotzo, circa 300 metres, Grand Comoro Id.

Range. Comoro Islands.

Phelsuma madagascariensis abbotti Stejneger

1893b. *Phelsuma abbotti* Stejneger, Proc. U. S. Nat. Mus., **16**, p. 716: Aldabra Island.
1893. Abbott, p. 762.
1939a. Rendahl, p. 266.
1909h. *Phelsuma madagascariense* Boulenger (part), p. 297 (Aldabra).
1911d. *Phelsuma madagascariense* var. *abbotti* Boulenger, p. 378.
1913. Boettger, p. 333.

Description. Snout 1.6 times as long as the distance between the eye and the ear-opening, vertical diameter of the latter not half that of the former; rostral with median cleft above; centre of nostril above first labial; nostril between first labial and 3 nasals, the uppermost separated from its fellow by 1–3 granules; upper labials 7–8; lower labials 7–7; chin region covered with enlarged scales of which the outer are much larger than the inner, the latter posteriorly merging into the gulars.

Back covered with keeled granules; ventral scales smooth; males with 33–34 preano-femoral pores forming an uninterrupted series; about 18 transverse lamellae beneath fourth toe anteriorly; tail, when unregenerate, covered above with smooth scales, below with smooth imbricate scales of which the median series is strongly transversely enlarged.

Coloration. Above, dark brown or olive slate; a dark streak from nostril through eye to above ear-opening; back, on each side of vertebral line, purplish; flanks and upper surface of limbs marbled with blackish; tail purplish. Below, whitish, a dusky ∩-shaped mark following contour of lower jaw; throat with a second chevron-like mark.

Measurements. Total length of type ♂, 127 (57 + 70) mm., of a topotype ♀, 106 + (49 + 57 +) mm. (M.C.Z. 22611).

Remarks. Boettger (1913), comparing typical *madagascariensis* with a series of *abbotti* states that the latter is consistently smaller,

that its snout *averages* somewhat shorter, that the ear-opening is *usually* smaller, and that the chin shields are more sharply differentiated from the gular granules. He adds that in scalation, coloration, and markings—particularly those on the throat—the similarities are amazing.

With only a single specimen I can offer no opinion, apparent differences in the description, however, may be ascribed to the paucity of material, little being added to the original description.

Habitat. Common on the walls of houses (Voeltzkow).

Localities. **Aldabra Id.**: Malabar; Picard; Takamaka. **Assumption Id.**

Range. Aldabra Islands.

Phelsuma madagascariensis longinsulae Rendahl

1869a. *Pachydactylus cepedianus* Peters (part, none of Merrem), p. 13.
1877b. Peters (part), p. 455.
1885d. *Phelsuma madagascariense* Boulenger (part), p. 214.
1909h. Boulenger (part), p. 297.
1911d. Boulenger, p. 377.
1936b. Parker, p. 446.
1939a. *Phelsuma longinsulae* Rendahl, Zool. Jahrb. Syst., **72**, p. 279: Long Island, Seychelle Islands.
1939a. *Phelsuma pulchrum* Rendahl, Zool. Jahrb. Syst., **72**, pp. 280, 320: Mahe Island, Seychelle Islands.
1939a. *Phelsuma pulchrum cousinense* Rendahl, Zool. Jahrb. Syst., **72**, pp. 281, 283, fig. 6: Cousin Island, Seychelle Islands.

Description. Snout 1.7 to 2[1] times as long as the distance between the eye and the ear-opening, vertical diameter of the latter about three-quarters that of the former; rostral with median cleft above; centre of nostril above first labial; nostril between first labial and 3 nasals; the uppermost separated from its fellow by 1–3 granules; upper labials 9–11; lower labials 7–9; chin region covered with enlarged scales of which the outer are much larger than the inner, the latter posteriorly merging into the gulars.

Back covered with smooth granules; ventral scales smooth; males with 28–35 preano-femoral pores forming an uninterrupted series; about 17–18 transverse lamellae beneath fourth toe anteriorly; tail, when unregenerate, covered above with smooth scales, below with smooth imbricate scales of which the median series is strongly transversely enlarged.

[1] Apparently to 2.2 times in *cousinense*.

Coloration. Above, purplish (green in life) variegated with lighter (orange red), viz.:—an orange streak from nostril to eye; a ∩-shaped mark in frontal region; back with a vertebral line flanked by more or less coalescing spots; flanks with, or without, another series; limbs variegated with lighter; tail spotted or cross-barred with lighter. Below, whitish, a violet ∩-shaped mark following contour of lower jaw; throat (yellowish green in life) with, or without, dusky flecking; end of tail sometimes greenish.

Measurements. Total length of largest cotype of *longinsulae,* 141 (65 + 76) mm.; of *pulchra,* 141 (63 + 78) mm.; of *cousinense,* head and body only, as tail missing, 65 mm.

Total length of ♂, 132 (62 + 70) mm.; of ♀, 102 (45 + 57) mm. (Both M.C.Z. 3086).

Remarks. No characters or key for distinguishing the three forms named by Rendahl are furnished by that author, on the contrary the overlap of every character for which he furnishes data apparently precludes the recognition of *pulchrum* and *cousinense.*

Habitat. From 800 to 1400 feet (Boulenger).

Localities. **Seychelle** and **Amirante Islands:** Bird Id.; Cousin Id.; D'Arros Id.; Dennis Id.; Frigate Id.; Long Id.; Mahe Id.—Bel Air, Cascade, Cascade Estate, Chateau Margot, Port Victoria, Sans Souci; Marie Louise Id.; Morne Id.; Praslin Id., Silhouette Id.; St. Joseph's Id.

Range. Seychelle and Amirante Islands.

Phelsuma madagascariensis andamanensis Blyth

1860. *Phelsuma andamanense* Blyth, Journ. Asiatic Soc. Bengal, **29**, p. 108: Andaman Islands.
1864. Günther, p. 112.
1868. Theobald, p. 74.
1870. Stoliczka, p. 162.
1871. Anderson, p. 160.
1873. Stoliczka, p. 163.
1874. Theobald, p. 74.
1885d. Boulenger, p. 212.
1890. Boulenger, p. 106.
1904. Annandale, p. 14.
1935. Smith, M. A., p. 121, fig. 35.
1864. *Gecko chameleon* Tytler, Journ. Asiatic Soc. Bengal, **33**, p. 548: Andaman Islands.

Description. Snout 1.7 to 2 times as long as the distance between the eye and the ear-opening, vertical diameter of the latter about a

quarter[1] to a half that of the former; rostral with median cleft above; centre of nostril above first labial; nostril between first labial and 3 nasals, the uppermost separated from its fellow by 2–3 granules; upper labials 8–11; lower labials 6–10; chin region covered with enlarged scales of which the outer are slightly larger than the inner, the latter posteriorly merging into the gulars.

Back covered with smooth granules; ventral scales smooth; males with 24–32 preano-femoral pores forming an uninterrupted series; about 15–16 transverse lamellae beneath fourth toe anteriorly; tail, when unregenerate, covered above with smooth scales, below with smooth imbricate scales of which the median series is strongly transversely enlarged.

Coloration. Above, greenish (rich emerald green in life), uniform or spotted with reddish or yellowish orange; an orange streak from nostril through eye to ear; an orange ∩-shaped marking in frontal region present or absent; one or two orange streaks on neck; back anteriorly with a vertebral line; tail uniformly green or blue. Below, whitish (bright yellow in life), immaculate. Tongue bright red. In the dark the bright colors and markings disappear (Tytler).

Measurements. Total length of ♂, 126 (50 + 76) mm.; of ♀, 100 (50 + 50) mm. (M.C.Z. 7148), but both exceeded by an unsexed record of 136 (63 + 73) mm. furnished by M. A. Smith (1935).

Remarks. Boulenger (1885d) places this species in the section of his key in which the centre of the nostril is above the rostro-labial suture, this is not the case, however, with Malcolm Smith's (1935) figure nor yet in our topotype (M.C.Z. 7148). Is it possible that two superficially similar species occur on the islands?

Habits. Diurnal and arboreal, hiding beneath bark of trees, but also found in houses and frequently feeding on the ground (Stoliczka).

Localities. **Andaman Islands:** Port Blair.

Range. Andaman Islands.

Phelsuma madagascariensis parkeri Loveridge

1913. *Phelsumia madagascariensis* Boettger (not Gray), p. 350.
1941. *Phelsuma madagascariense* ? subsp. Moreau & Pakenham, 1940, p. 107.
1941. *Phelsuma madagascariensis parkeri* Loveridge, Proc. Biol. Soc. Washington, **54**, p. 175: Kinowe, Pemba Island.

Description. Snout 1.6 to 2 times as long as the distance between the eye and the ear-opening, vertical diameter of the latter three-

[1] Quarter *fide* Boulenger.

quarters of, or equal to, that of the former; rostral without, rarely with, median cleft above; centre of nostril above first labial; nostril between first labial and 3 nasals, the uppermost separated from its fellow by 1–2 granules; upper labials 8–10; lower labials 7–9; chin region covered with enlarged scales of which the outer are much larger than the inner, the latter posteriorly merging into the gulars.

Back covered with smooth granules; ventral scales smooth; males with 32-38 preano-femoral pores forming an uninterrupted series; about 16–17 transverse lamellae beneath fourth toe anteriorly; tail, when unregenerate, covered above with smooth scales, below with smooth imbricate scales of which the median series is strongly transversely enlarged.

Coloration. Above, bluish gray (green in life) finely vermiculate with black on back and limbs; tail paler, uniform. Below, whitish, immaculate, even on throat.

Measurements. Total length of a paratype ♂, 148 + (65 + 83 +) mm., the tail in process of regeneration; total length of type ♀, 148 (65 + 83) mm.

Remarks. The foregoing description is based almost exclusively on the type series of seven specimens in the Museum of Comparative Zoölogy, collected by Mr. R. H. W. Pakenham.

Breeding. On December 3, the type ♀ held two ova, each measuring about 13 x 8 mm.

Habitat. Coconut palms.

Localities. **Pemba Island:** Kinasini; Kinowe; Wete.

Range. Pemba Island.

Phelsuma madagascariensis madagascariensis Gray

1836. *Platydactylus Cepedianus* Duméril & Bibron (part), p. 301.
1851. Duméril, p. 34.
1845. *Phelsuma madagascariensis*[1] Gray, Cat. Lizards Brit. Mus., p. 166: Madagascar.
1885d. Boulenger (part), p. 214 (omit Seychelles and Zungomero).
1887a. Boulenger, p. 490.
1887. Strauch, p. 18.
1893a. Boettger, p. 37.
1903b. Ferreira, p. 21.
1909. Mocquard, pp. 19, 93.
1910a. Andersson, p. 8.
1911. Lampe, p. 157.
1913. Boettger, pp. 291, 321, 327 (not 350).
1913a. Methuen & Hewitt, p. 187.
1915. Rawitz, p. 618, pl. xlii, fig. 22.
1917. Voeltzkow, p. 460.
1922. Kaudern, p. 418.
1925b. Flower, p. 941.
1931. Angel, p. 514.
1933b. Mertens, p. 265.
1939a. Rendahl, pp. 264, 266, fig. B.
1870a. *Phelsuma grandis* Gray, Ann. Mag. Nat. Hist. (4), 6, p. 191: Madagascar.
1909. Mocquard, p. 94.
1881c. *Pachydactylus Cepedianus* var. *madagascariensis* Boettger, p. 458, pl. ii, fig. 5.
1881c. *Pachydactylus grandis* Boettger, p. 530.
1884b. *Pachdactylus cepedianus* Fischer (not Cuvier), p. 33.

Further citations of '*madagascariensis*' will be found under its various races, also under *d. dubia*, and *mutabilis*.

Description. Snout 1.6 to 2[2] times as long as the distance between the eye and the ear-opening, vertical diameter of the latter about half[3] to two-thirds that of the former; rostral with, rarely without, a median cleft above; centre of nostril above first labial; nostril between first labial and 3 nasals, the uppermost separated from its fellow by 1 granule; upper labials 7–10; lower labials 6–9; chin region covered with enlarged scales of which the outer are much larger than the inner, the latter posteriorly merging into the gulars.

Back covered with granules (smooth in young, keeled laterally and

[1] Some of the references following are to *madagascariense*.
[2] Apparently 2.3 *fide* Rendahl.
[3] Not half *fide* Boulenger (1885d).

in pelvic region in old); ventral scales smooth; males with 34–50 preano-femoral pores forming an uninterrupted series; about 16–19 transverse lamellae beneath fourth toe anteriorly; tail, when unregenerate, covered above with smooth scales, below with smooth imbricate scales of which the median series is strongly transversely enlarged.

Coloration. Above, greenish, blue gray, plumbeous, or purplish, sometimes uniform, more often marked as follows: an orange streak from nostril to eye but going no further; an orange spot or spots, which may take a ∩-shaped form, in frontal region; a few irregular pale spots on either side of back or only posteriorly in lumbar region. Below, whitish or greenish, throat uniform or with dusky vermiculations often taking the form of a series of indistinct, ∩-shaped markings; tail uniform. Iris bluish or grayish.

Measurements. Total length of ♂, 259 (117 + 142) mm., but tail regenerated, from S.W. of Mt. d'Ambre; total length of ♀, 212 (118 + 94) mm. (Boettger).

Remarks. It must be borne in mind that young males of all species are apt to have fewer pores than those assigned to the species, and in giant species like *madagascariensis* the fact that they are young may consequently be overlooked. Young specimens of *madagascariensis* are likely to be confused with *laticauda* which occurs in the same localities, but whose tail is much vermiculate above and whose females breed at a length of 40 mm. from snout to anus. Boettger states that in *madagascariensis* the caudal scales *above* are arranged in whorls consisting of 5–6 scales, whereas in sixty cotypes of *laticauda* there were 8–10, average 9, scales to a whorl, other writers have claimed 7 scales for both species, the limited material at my disposal supported Boettger.

Anatomy. The nervous system is discussed by Rawitz (1915).

Longevity. Flower records one as living for a year and a quarter, but mentions that a Vienna correspondent claimed to have kept one for over three years.

Habits. Common in woods, but also found in houses (Kaudern).

Localities. **Madagascar:** Ambila (Ambilo); Ambongo; Andranolava; Anjamala (Ianzamaly) near Tulear[1], Angurutani; Col Pierre Radama; Fandrarazana; Kandrany (Kandani); Majunga; Mt. d'Ambre—S.W. of; Nosy Be; Nosy Sakatia; Ste. Marie Id.; Ste. Marie de Marovoay; Sakana; Soalala; Tamatave[2]; Tampina.

[1] This young specimen, being the only southwestern record, should be reëxamined.

[2] *Fide* Boulenger (1887a) ex. Cowan coll.

Range. Madagascar (chiefly northern) and adjacent islands. Recorded also from Quilimane, Mozambique (Boulenger, 1885d).

Phelsuma laticauda (Boettger)

1869a. *Pachydactylus cepedianus* Peters (part), p. 13.
1873c. Peters, p. 792.
1879b. Boettger, p. 480.
1880b. Peters, p. 510.
1880a. *Pachydactylus laticauda* Boettger (part), Zool. Anz., **3**, p. 280: Nosy Be, Northwest Madagascar (omit Tamatave).
1880b. Peters, p. 510.
1881c. Boettger (part), pp. 461, 530, pl. ii, fig. 6.
1885d. Müller, p. 709.
1885d. *Phelsuma laticauda* Boulenger, p. 215.
1887. Strauch, p. 18.
1890a. Müller, p. 290.
1893a. Boettger (part), p. 39.
1903b. Ferreira, p. 21.
1909h. Boulenger, p. 297.
1909. Mocquard, pp. 19, 88.
1913. Boettger, pp. 339, 342 (as *Phelsumia*).
1915. Rawitz, p. 613, pl. xlii, figs. 18–21.
1917. Voeltzkow, p. 460.
1939a. Rendahl, p. 269.
1929d. *Phelsuma laticauda laticauda* Barbour & Loveridge, pp. 312, 314.

Further citations of '*laticauda*' will be found under *d. dubia*, *lineata* and *breviceps*.

Description. Snout 1.3 to 1.6 times as long as the distance between the eye and the ear-opening, vertical diameter of the latter about two-thirds that of the former; rostral without, rarely with, a median cleft above; centre of nostril above first labial; nostril between first labial (sometimes excluded) and 3 nasals; the uppermost separated from its fellow by 1 granule; upper labials 6–9; lower labials 6–9; chin region covered with enlarged scales of which the outer are much larger than the inner, the latter posteriorly merging into the gular granules.

Back covered with smooth granules; ventral scales smooth; males with 24–28 preano-femoral pores forming an uninterrupted series; about 16–18 transverse lamellae beneath fourth toe anteriorly; tail, when unregenerate, covered above with smooth scales, below with smooth imbricate scales of which the median series is slightly transversely enlarged.

Coloration. Above, purplish gray to olive green (bright green in life); head with two broad, transverse, light (reddish orange) crossbars on snout and a third on occiput; back uniform anteriorly but lumbar region with light (brick red) irregular, more or less coalescing, blotches; on flanks, at least from axilla to groin, a dark lateral band (or two narrower lines very close together) present or absent; limbs and tail characteristically vermiculate with short dark lines; tip of tail sometimes bluish. Below, whitish (hinder part of throat and whole of tail with transverse patches of bright yellow). Irish violet red.

Measurements. Total length of largest cotype, 120 (56 + 64) mm., probably a ♂; largest ♀, 104 (50 + 54) mm. from Anjouan Id. (A.M.N.H. 24783).

Remarks. Boettger (1880a, 1881c, 1893a), in his description of *laticauda*, included two young geckos from Tamatave, which differed from his 77 cotypes from Nosy Be in their round tails and blue-violet ground color with the dark lateral stripes extending forwards to the snout. I have little doubt that these Tamatave specimens were young *lineata*, a species with which Boettger wrongly supposed his *laticauda* might eventually be synonymized. The specimens from Didy, near Tamatave, recorded by Barbour (1918) have been examined and transferred to *lineata*.

Mocquard's (1902a) record of *laticauda* from Fort Dauphin is tentatively referred to *breviceps*, which was subsequently recorded from there by Boettger (1913). Unless introduced, it seems improbable that this northwestern species should occur in the extreme southeast. I am also somewhat doubtful regarding Methuen and Hewitt's (1913a) specimens from the southwest.

It must, I suppose, be considered an open question as to whether *laticauda* occurs on Zanzibar. The data of Tornier's (1900b, p. 588) specimens Nos. 2, 3, and 4 of the Werth collection, as supplied by Tornier, actually agree with *laticauda*, while Nos. 1 and 5 are indubitably *d. dubia*. A re-examination of my Zanzibar material, once referred to *laticauda* as being the older name, shows that they are all *d. dubia* as now understood. The question can be settled only by an inspection of Tornier's geckos Nos. 2, 3, and 4 to see whether the dorsal granules are not obtusely keeled.

P. dubia, it might be added, does not have the subcaudals transversely enlarged, and *P. laticauda* is much more likely to be mistaken for a young *madagascariensis* which, however, has a uniformly colored tail.

Anatomy. The nervous system is discussed by Rawitz (1915).

Localities. **Comoro Islands:** Anjouan Id.; Farquhar Id.; Mayotte Id. **Madagascar:** Nosy (Nossi) Be; Nosy Faly. West Madagascar (*fide* Methuen and Hewitt).

I have seen a specimen from Anjouan (Amer. Mus. Nat. Hist. coll.); the Farquhar record (Boulenger, 1919h) requires confirmation as *madagascariensis* also occurs; regarding the Mayotte specimens Boettger (1913) says quite definitely that they are not *comorensis*, which one would have expected them to be.

Range. Islands of northwest Madagascar and Comoro; reported from western Madagascar by Methuen & Hewitt.

Phelsuma guttata Kaudern

1922. *Phelsuma guttata* Kaudern, Zool. Jahrb. Syst., p. 418, pl. xii, figs 1–1a: Fandrarazana, Northern Madagascar.
1933b. Mertens, p. 265.
1939a. Rendahl, p. 268.

Description. Snout 1.6 times as long as the distance between the eye and the ear-opening, vertical diameter of the latter about half that of the former; rostral without a median cleft above; centre of nostril above first labial; nostril between first labial and 3 nasals, the uppermost separated from its fellow by 2 granules; upper labials 8–11; lower labials 6–9; chin region covered with 6–10 enlarged scales surrounding a group of much smaller scales and followed also by smaller scales which posteriorly merge into the gular granules.

Back covered with smooth granules; ventral scales smooth; male unknown; tail, when unregenerate or regenerate, covered above with smooth scales, below with smooth imbricate scales of which the median series is transversely enlarged.

Coloration. Above, dark violet; snout flecked with lighter; a dark streak from nostril through eye to neck above ear-opening, a less conspicuous wavy streak from angle of mouth to neck, below, but parallel with it is a third coming from chin, a fourth, coming from throat, also extends on to side of neck, an ill-defined fifth, reaching to base of fore arm, may also be present; back flecked with black and white; flanks with two or three rows of white flecks some of which fuse to form a light line above the hind limb; limbs with large white spots. Below, whitish, chin and throat with three chevron-shaped markings whose arms continue on to sides of neck; belly uniform; tail flecked with violet.

Measurements. Total length of ♀, 120 (52 + 68) mm., from Col Pierre Radama; the holotype ♀ was only 102 (56.5 + 45.5) mm.

Breeding. The larger ♀ held big eggs (Mertens).

Remarks. This species is known to me only from the figures and descriptions of the four known females.

Localities. **Madagascar**: Col Pierre Radama; Fandrarazana.

Range. Northern Madagascar.

Phelsuma mutabilis (Grandidier)

1869. *Platydactylus mutabilis* Grandidier, Rev. Mag. Zool. (2), **21**, p. 341: Fierin and Menabe (Menaba), western Madagascar.
1881c. *Peripia mutabilis* Boettger, p. 531.
1895a. *Phelsuma madagascariense* Mocquard (not Gray), p. 94.
1901b. *Phelsuma androyense* Mocquard, Bull. Mus. Paris, **7**, p. 252: North Androy, Magagascar.
1902a. *Phelsuma mutabilis* Mocquard, p. 10.
1909. Mocquard, pp. 19, 93.
1913a. Methuen & Hewitt, p. 186.
1925b. Angel, p. 60.
1931d. Angel, p. 514.
1934a. Angel, p. 312.
1939a. Rendahl, p. 268.
1913. *Phelsumia* (*sic*) *micropholis* Boettger, in Voeltzkow, Reise in Ostafrika, **3**, p. 293, pl. xxiv, figs. 6–7: Menabe and Manampetsa (Tsimanampetso), southwestern Madagascar.
1922. Kaudern, pp. 418, 457.
1925b. Angel, p. 60.
1931d. Angel, p. 515.
1933b. Mertens, p. 265.
1935d. Angel, p. 470.
1939a. Rendahl, p. 266.

Description. Snout 1.3 to 1.6 times as long as the distance between the eye and the ear-opening, vertical diameter of the latter about two-thirds that of the former; rostral with, rarely without[1], a median cleft above; centre of nostril above first labial; nostril between first labial and 2–3 nasals, the uppermost separated from its fellow by 1–3 granules; upper labials 6–8; lower labials 5–6; chin region covered with enlarged scales of which the outer three or four pairs are much larger than the inner, the latter posteriorly merging into the gulars.

[1] Specimens with and without median cleft present in Boettger's type series of *micropholis* from both type localities.

Back covered with smooth granules; ventral scales smooth; males with (?24[1]) 27–32 preano-femoral pores forming an uninterrupted series; about 10–12 transverse lamellae beneath fourth toe anteriorly; tail, when unregenerate, covered above with smooth scales; below with smooth, imbricate scales of which the median series is both slightly and strongly transversely enlarged, one strongly dilated alternating with two slightly dilated.

Coloration. Above, pale brown; a dark brown streak from nostril through eye to neck above ear-opening; two narrower brown lines on snout merge on occiput and continue to nape where other irregular lines may be present; back blotched, flecked, or variegated with darker, such markings taking the form of cross-bars on limbs and streaks on tail. Below, whitish, immaculate except for a dark ∩-shaped mark following the contour of the lower jaw.

Measurements. Total length of ♂, 96 (44 + 52) mm., from Manampetsa, of ♀, 102 (49 + 53) mm., from Manabe.

Remarks. Mocquard (1895a) referred Grandidier's five cotypes of *mutabilis* to the synonymy of *madagascariensis*. Later (1902a) he not only recognized its validity but referred his own recently-described *androyense* to the synonymy. After an examination of an extensive series of *microphol*is, including the cotypes in the Museum of Comparative Zoölogy, I have no hesitation in adding it to the synonymy also.

I am not so certain that what Angel (1925b, 1931d) called *microphol*is belongs here, however. His specimen, a ♀, from Tsivono, north of Tulear, is said to have the nostril in contact with the rostral whereas the numerous paratypes of *microphol*is, as pointed out by Mertens (1933b), are constant in having the nostril separated from the rostral.

Localities. **Madagascar:** Ampanihy; Andranohinaly; Andranolaho; Andringitra Mtns.; Androy—north; Col Pierre Radama; Fierin[2]; Mevatanana; Manampetsa (Tsimanampetso); Manasoa; Maroamalona; Menabe (Menaba); Ste. Marie de Marovoay; Tanosy; Tongobory; Tsivonoina; Tulear.

The majority of these are in the southwest so that Mertens (1933b) record of Col Pierre Radama from the northeast is somewhat surprising though doubtless correct for he compared his series with the types of *microphol*is.

Range. Madagascar.

[1] See '*Remarks*.'

[2] Fierin (Grandidier, 1869) is probably Firinga (Grandidier's map, 1925).

Phelsuma breviceps Boettger

1894b. *Phelsuma breviceps* Boettger, Zool. Anz., **17**, p. 137: Southern Madagascar.
1898c. Boulenger, p. 914.
1909. Mocquard, pp. 19, 89.
1913. Boettger, p. 292 (as *Phelsumia*).
1934a. Angel, p. 312.
1935d. Angel, p. 470.
1939a. Rendahl, p. 267.
1902a. *?Phelsuma laticauda* Mocquard (? not Boettger), p. 10.

Description. Snout 1.3 to 1.6 times as long as the distance between the eye and the ear-opening, vertical diameter of the latter about two-thirds that of the former; rostral without a median cleft above; centre of nostril above first labial; nostril between first labial and 2 nasals, the uppermost separated from its fellow by 1 granule; upper labials 6–7; lower labials 5–6; chin region covered by two pairs of very large postmentals which are sharply distinct from the gular granules following them.

Back covered with smooth granules; ventral scales smooth; males with 27–31 preano-femoral pores forming an uninterrupted series; about 11 transverse lamellae beneath fourth toe anteriorly; tail, when unregenerate, covered above with smooth scales, below with smooth imbricate scales of which the median series (at least in a regenerated tail) is transversely enlarged.

Coloration. Above, olive gray, uniform or variegated with dark brown; a dark brown streak, bordered below by a lighter one, from nostril through eye to above ear-opening. Below, chin and throat yellowish spotted with brown; belly and tail whitish, the latter spotted with brown.

Measurements. Total length of ♂, 107 (48 + 59) mm., of ♀, 73 + (45 + 28+) mm., both from Manampetsa. The holotype ♂ also had a head and body length of 48 mm. but his tail was regenerated.

Localities. **Madagascar:** Andranovaho; Fort Dauphin; Manampetsa (Manampetso; Tsimanampetso).

Range. Southern Madagascar.

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* An asterisk signifies the oriental *P. m. andamanensis* only dealt with

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REVISION OF THE AFRICAN LIZARDS OF THE FAMILY GERRHOSAURIDAE

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No. 11. —*Revision of the African Lizards of the Family Gerrhosauridae*[1]

By Arthur Loveridge

Except for Hewitt (1915, p. 103) having published a key to the seven species of *Tetradactylus* known at that time, and later Schmidt (1919, p. 518) doing the same for *Gerrhosaurus*, no attempt has been made to evaluate the twenty-three species of this family described during the fifty-five years which have elapsed since the treatment of the GERRHOSAURIDAE in Boulenger's (1887a, p. 119) monumental "Catalogue of Lizards in the British Museum."

In the present paper, therefore, it has been my endeavour to furnish a synopsis of all additions to our knowledge of this group since 1887. The treatment followed being the same as that adopted in other papers of this series[2], it appears unnecessary to repeat the procedure here.

For the purpose of this revision I have utilized the extensive material in the Museum of Comparative Zoölogy, supplemented by loans from the American Museum of Natural History, Field Museum of Natural History and the University of Michigan Museum of Zoology. I take this opportunity of expressing my thanks to the curators, Mr. Bogert, Mr. C. H. Pope, and Mrs. H. T. Gaige for their friendly cooperation in this matter. I am also indebted to Mr. V. FitzSimons of the Transvaal Museum for answering numerous questions regarding the wealth of material of this group which he has collected. Owing to unsettled conditions in Europe other queries have remained unanswered and will have to remain so.

One of those that may never be satisfactorily settled is the status of *Gerrhosaurus dulignoni* Rochebrune. Type locality: Dakar; (1884a, Faune de la Senegambie, p. 110, pl. xii, fig. 2), striped with red above and said to be heavenly blue below. The figure is undoubtedly that of a *Gerrhosaurus*, yet no species of the family is known from west of Togo except for Rochebrune's listing of *typicus* (p. 109), *nigrolineatus* (p. 108), *bibroni* (p. 109, pl. xii, fig. 1), and *flavigularis* (p. 108), each with definite localities. In consequence, perhaps, the following year, Müller (1885d, p. 703) listed *flavigularis* from Liberia, though on the West coast there is no other record nearer than Cape Province!

With the exception of these references, which I have ignored, I have included all those on GERRHOSAURIDAE resulting from a search

[1] Published with the aid of a special gift from Mr. George R. Agassiz.

[2] Revision of the African Lizards of the Family Amphisbaenidae, 1941, Bull. Mus. Comp. Zoöl., **87**, pp. 353–451.
Revision of the African Terrapin of the Family Pelomedusidae, 1941, Bull. Mus. Comp. Zoöl., **88**, pp. 467–524.

of 1500 papers on African herpetology. Undoubtedly others, chiefly anatomical, will have escaped me.

Apart from the allocation to subspecific rank of a number of forms, and the description of a new race, *Gerrhosaurus flavigularis fitzsimonsi*, the only taxonomic changes are the synonymizing of the undermentioned species:

Gerrhosaurus cipriani Scortecci = *G. v. validus* A. Smith
Gerrhosaurus v. damarensis FitzSimons = *G. v. maltzahni* de Grys
Gerrhosaurus f. intermedia Lönnberg = *G. n. nigrolineatus* Hallowell
Gerrhosaurus n. australis FitzSimons = *G. n. nigrolineatus* Hallowell
Gerrhosaurus trivittatus (Peters) = *C. subtessellatus* (Smith)
Cordylosaurus t. australis Hewitt = *C. subtessellatus* (Smith)
Tetradactylus lundensis Monard = ? *T. f. boulengeri* de Witte

Index to the Species Recognized

* Represented in the collections of the Museum of Comparative Zoölogy; examples of species without asterisk are earnestly desired.

Family GERRHOSAURIDAE

1884a. *Gerrhosauridae* Boulenger, Ann. Mag. Nat. Hist. (5), **14**, pp. 120, 122.

For synonymy see Boulenger, 1887a, Cat. Lizards Brit. Mus., **3**, p. 119, from whom the following definition is adapted and amended.

Habit robust, moderate, or vermiform; head covered with symmetrical shields; eyes present; eyelids well developed; tympanum distinct; dentition pleurodont, teeth closely set, hollow at the base, with long cylindrical shafts and conical or bicuspid crowns, pterygoid teeth often present; tongue moderate, elongate, arrow-headed, bifid posteriorly, covered with imbricate scale-like papillae or oblique plicae converging towards the median line; body with squarish or rhomboidal imbricate scales, forming regular longitudinal and transverse series (in African but not in all Malagasy species); a lateral fold covered with granular scales (except in the Malagasy genus *Tracheloptychus*); limbs well developed or rudimentary or absent posteriorly; femoral pores present or absent (in some serpentiform species); tail long and fragile.

Skull similar to that of the LACERTIDAE in every respect, with dermal ossification roofing over the supratemporal fossae; body furnished with osteodermal plates underlying the scales and showing a system of longitudinal tubules intersecting a transverse one as in the SCINCIDAE, this structure being usually more distinct on the ventral plates than on the thicker and rougher dorsal ones; clavicle dilated and loop-shaped proximally; interclavicle cruciform.

Range. Africa south of Senaar, i. e. about 13° N.; Madagascar.

Remarks. Camp (1923, p. 316) places the GERRHOSAURIDAE in a superfamily Lacertoidea of the section Scincomorpha, division Autarchoglossa of the suborder Sauria, thus confirming Boulenger's conclusions as to the intermediate position which they occupy between LACERTIDAE and SCINCIDAE. His paper should be consulted for details.

Key to the Genera

1. Ventral plates not forming straight transverse series; nostril pierced between 2 nasals, first labial, *and the rostral;* range: Madagascar . . . . . Malagasy genera

   Ventral plates forming a perfectly straight transverse series; range: Africa 2

2. Tongue[1] covered, or nearly covered with imbricate scale-like papillae; nostril pierced between 2 nasals and first labial; limbs well-developed; femoral pores present 3
   Tongue covered with oblique plicae 4

3. Prefrontals and frontoparietals present; lower eyelid scaly; subdigital scales smooth or tubercular . . . . . *Gerrhosaurus* (p. 488)
   Prefrontals absent; frontoparietals present (in young) or absent (in adults); lower eyelid with a transparent disk; subdigital scales keeled . . . . . *Cordylosaurus* (p. 520)

4. Nostril pierced between 2 (rarely 3) nasals and first labial (latter rarely excluded); prefrontals absent; frontoparietals present; fore limbs present or absent; femoral pores present or absent . . . . . *Tetradactylus* (p. 523)
   Nostril pierced in a single nasal (? or between it and first labial); prefrontals and frontoparietals present; fore limbs absent; hind limbs minute; femoral pores absent . . . . . *Paratetradactylus* (p. 534)

Genus GERRHOSAURUS

1828. *Gerrhosaurus* Wiegmann, Isis von Oken, p. 378 (type *flavigularis*).
1836.[2] *Pleurotuchus* A. Smith, Mag. Zool. Bot. (Jardine), **1**, p. 142 (type *typicus*).

For further synonymy see Boulenger, 1887a, Cat. Lizards Brit. Mus., **3**, p. 120.

Tongue covered[1] with imbricate scale-like papillae; nostril pierced between 2 nasals and first labial; prefrontals and frontoparietal present; lower eyelid scaly; dorsal and ventral scales forming straight longitudinal and transverse series; a strong lateral fold; limbs well developed; subdigital scales smooth or tubercular; femoral pores present.

Range. Africa south of Senaar, i. e. about 13° N., Anglo-Egyptian Sudan.

[1] As at the time of writing the Museum of Comparative Zoölogy lacked an example of *Cordylosaurus*, I appealed to Mr. V. FitzSimons for his opinion. He replied as follows: "The scaling of tongue in our three genera of *Gerrhosauridae* appears to show a gradation as follows: in *Gerrhosaurus* tongue almost completely covered with scale-like papillae, oblique plicae being confined to posterior lobes; in *Cordylosaurus* papillae extend over anterior half of tongue and plicae over posterior half; in *Tetradactylus* papillae confined to tip or anterior quarter of tongue, remainder with oblique plicae."

[2] Aug. 1838 (not 1837), *fide* Sherborn, 1929, Index Animal., O-P, p. 5041.

STATISTICAL SYNOPSIS OF VARIATION IN THE GENUS GERRHOSAURUS

Species	Dorsal scale-rows longitudinally	Dorsal scale-rows transversely	Ventral scale-rows longitudinally	Ventral scale-rows transversely	Femoral pores on either side	Lamellae under fourth toe	Supraciliaries (unusual variations in parenthesis)
v. validus	28–34	50–56	14–20	40–44	17–25	18–22	5
v. skoogi	35	64	18–22	?	24–27	?	5
v. maltzahni	25–30	50–55	12–14	41–44	20–24	15–22	5 (6)
m. zechi	18–20	32–37	10	33	12–15	15	5 (3, 4)
m. bottegoi	17–20	33–36	10	32–34	10–17	13–17	5
m. grandis	16–18	32–36	10	30–32	10–13	12–14	5
m. major	17–21	32–38	10 (9)	31–34	12–14	13–16	5 (3, 4)
typicus	22–24	56–58	10	30–35	15–17	16–18	5
n. auritus	26	50–57	8	32–34	14–16	16–18	4
n. nigrolineatus	20–26	52–60	8	32–36	12–21	14–18	4 (3, 5)
f. fitzsimonsi	20–22	59–61	8	34–36	13–15	17–19	5 (6)
f. flavigularis	20–24	55–67	8	32–38	10–16	17–21	5 (6)

Key to the Species

1. Ventrals in 12 or more rows across belly 2
   Ventrals in 10 or less rows across belly 5

2. Subocular excluded from lip by labial; breadth of tympanic shield included in its depth from 2 (adult) to 3 (young) times 3
   Subocular reaches lip between labials; breadth of tympanic shield included in its depth from 1.5 (adult) to 4 (young) times 4

3. Dorsals in 30–34 longitudinal and 50–56 transverse rows; ventrals in 14–20 longitudinal rows; femoral pores 17–25 on each side; lamellae beneath fourth toe 18–23; range; Orange Free State and Transvaal north to Southern Rhodesia and Mozambique . . . . . *v. validus* (p. 492)

4. Dorsals in 35 longitudinal and 64 transverse rows; ventrals in 18–22 longitudinal rows; femoral pores 24–27 on each side; range: Port Alexander, Angola ..... *v. skoogi*[1] (p. 494)

Dorsals in 26–30 longitudinal and 50–54 transverse rows; ventrals in 12–14 longitudinal rows; femoral pores 20–24 on each side; lamellae beneath fourth toe 15–22; range: South West Africa and Angola ... *v. maltzahni* (p. 495)

5. Ventrals in 10, *very* rarely 9, rows across belly 6
Ventrals in 8 rows across belly 11

6. Dorsals in 16–20 longitudinal and 31–37 transverse rows; laterals keeled and striated 7
Dorsals in 24 longitudinal and 55–56 transverse rows; laterals smooth .. 10

7. Head above, buff, each scale spotted with black 8
Head above, uniform buff or fulvous brown 9

8. Above head, body, and tail almost black, each scale with a small buff spot or streak arranged to form interrupted lines on back and sides; belly streaked with dusky; range: Belgian Congo and Togo ..... *m. zechi* (p. 497)

Above, head and body buff, each scale (except those forming an ill-defined, buff, dorsolateral line) heavily streaked with black or dark brown in regular lines on back and sides with a tendency to coalesce posteriorly and on tail where the buff survives only as spots; belly streaked with dusky; range: Central Tanganyika north through Kenya to Ethiopia and Eritrea ..... *m. bottegoi* (p. 498)

9. Above, head only buff though back anteriorly largely so, while posteriorly, as also on sides and tail, many scales are streaked with black or dark brown among which large buff blotches or spots are prominent; belly usually streaked with dusky; range: Zululand and Transvaal north to Morogoro, Tanganyika Territory ..... *m. grandis* (p. 500)

Above, head and body uniform buff or fulvous brown; belly uniform yellowish; range: Northern Rhodesia (?) and Mozambique north to Zanzibar along eastern Tanganyika Territory and eastern Kenya Colony *m. major* (p. 502)

[1] This race is known to me only from the original description of the unique type. The possibility that its sharp cutting jaws and coloration are attributable to preservation and partial bleaching should not be overlooked. Apparent differences in number of dorsals etc., as compared with those of *maltzahni*, may in part be due to method of counting, in part to the fact that so few specimens of the latter are known that the range may yet expand to include those of *skoogi*, a name which has many years priority over *maltzahni* should they prove to be synonymous. Conversely, perhaps, Angolan records attributed to the latter should really be referred to the former.

10. Size smaller; range: Little Namaqualand ....*typicus* (p. 505)

11. Supraciliaries 4, very rarely 3 or 5; distance from snout to behind ear included in distance from snout to anus 3.25 (hatchlings) to 4, rarely 5 (adults) times 12
    Supraciliaries 5, very rarely 6; distance from snout to behind ear included in distance from snout to anus 4.8 (young) to 6[1] (adults) times 13

12. Uniform sandy brown above; range: more arid areas of Bechuanaland and South West Africa (with single questionable records from Angola and N. Rhodesia) ..... *n. auritus* (p. 506)
    A pair of dark-edged, pale, dorsolateral lines; range: South West Africa, Bechuanaland and Transvaal north to Kenya highlands and west to Gaboon ..... *n. nigrolineatus* (p. 508)

13. Prefrontals *broadly* in contact, occasionally (20%) separated; range: Southern Tanganyika north through Kenya (chiefly coastal) to Ethiopia and Sennar ..... *f. fitzsimonsi* (p. 514)
    Prefrontals separated or narrowly in contact; range: Cape Province east to Natal, north to northern Mozambique and Northern Rhodesia ..... *f. flavigularis* (p. 516)

[1]to 8.4 times according to FitzSimons (1935b, p. 366).

Gerrhosaurus validus validus Smith

1849. *Gerrhosaurus vallidus* (*sic*) A. Smith, Illus. Zool. S. Africa, Rept., App., p. 9: Towards sources of Orange River, S. Africa.
1887a. Boulenger, p. 121 (amends spelling to *validus*).
1896a. Bocage, p. 98.
1898. Sclater, p. 105.
1909a. Chubb, p. 594.
1909b. Chubb, p. 35.
1910b. Boulenger, p. 480.
1910a. Hewitt, p. 62.
1910c. Hewitt, pp. 103, 104, 105.
1911c. Sternfeld, p. 417.
1913. Hewitt & Power, p. 157.
1920. Hewitt, pp. 91, 92, fig. 5.
1934. Pitman, p. 305.
1935. Broom, p. 20, fig. 5a.
1935b. FitzSimons, p. 362.
1935. Lawrence, p. 44.
1937a. FitzSimons, p. 269.
1939b. FitzSimons, p. 33.
1940. Malan, p. 192.
1854. *Gerrhosaurus robustus* Peters, Monatsb. Akad. Wiss. Berlin, p. 618: Tete, Mozambique.
1855. Peters, p. 47.
1864c. Gray, p. 58.
1864b. Peters, p. 377.
1865. Kirk, p. 227
1882a. Peters, p. 58, pl. ix.
1931. *Gerrhosaurus ciprianii* Scortecci, 1930b, Atti. Soc. Ital. Milano, **69**, p. 319: Old Enchopi, interior of Mozambique.
1934d. Scortecci, pp. 51–54, photo.

Further citations of '*validus*' *and* '*robustus*' will be found under *G. v. maltzahni* de Grys.

Native names. Caana (Sechuana: Peters)[1]; *isiqusa* (Matabele: Chubb).

Description. Head moderate, its length being included in the distance from snout to anus 4 (young) to 4.9 (adult) times; head shields smooth (young), feebly striated (halfgrown), or rugose (adult); rostral separated from, very rarely in contact with, the frontonasal; prefrontals broadly in contact; supraoculars 4; supraciliaries 5; sub-

[1] Misprinted *caaiia*, later corrected, disputed by Kirk, cf. 1864c, 1864b, 1865.

ocular excluded from lip by labial; tympanic shield narrow and band-like (young) or broad and subtriangular (adult); body cyclotetragonal or depressed; dorsals keeled, unicarinate (young), tricarinate (half-grown), or multicarinate (adult), and serrated, in 28–34[1] longitudinal and 50–56 transverse rows; laterals keeled and sometimes striated also; ventrals in 14–20[2] longitudinal and 40–44 transverse rows from pectoral to anal shields; femoral pores 17–25 on each side; fourth toe with 18–22 lamellae below; tail 1.3 (young) to 1.8 (adult) times the length of head and body.

Coloration. In this form the dark markings are so dominant that they assume the importance of the ground color, the arrangement followed is therefore the reverse of that adopted for *G. v. maltzahni* and other species with the sole exception of *G. m. zechi.*

Above, dark brown or blackish, head flecked and spotted with citron yellow; each dorsal scale with a citron yellow streak or spot on its inner edge; a broad, white, or lemon yellow, dorsolateral line from head to tail anteriorly, continuous in young, more or less interrupted and indistinct in adults; flanks with light vertical bars in young; limbs dark spotted with lighter. Below, throat, chest, and limbs whitish blotched with pale brown; belly and tail brownish or blackish with some white persisting as fine, light, longitudinal lines along the edges of the ventrals and subcaudals; soles of feet black.

Size. Total length of ♂, 681 (275 + 406) mm., of ♀, 509 (228 + 281) mm., both from Zimbabwe (FitzSimons).

Anatomy. The dentition, skeleton, and viscera have been described in detail by Peters (1882a), the branchial arch discussed by Hewitt (1920), temporal region of skull by Broom (1935), the skull by Malan (1940).

Remarks. Apparently Peters (1882a) was the first to point out that the shape of the tympanic shield varies with the age of the lizard. The type of *validus* in the British Museum has been recently re-ëxamined by FitzSimons (1937a). Mertens (1937b) considers that the original spelling, *vallidus,* may well be considered a misprint.

Diet. Orthoptera (Peters). The native story that they eat fowls, repeated by Kirk, is undoubtedly due, as suggested by Peters, to its being confused with the Nilotic monitor (*Varanus niloticus*).

Parasites. Mites (*Pterygosoma gerrhosauri*) reported by Lawrence.

[1] 28 *fide* Boulenger (1887a), my lowest is 30.

[2] 18–20 (A. Smith) was corrected by Boulenger (1887a) to 14–16, which is also the range of material in the Museum of Comparative Zoölogy. 18–20 *fide* FitzSimons (1939b), who writes (1942) me that 14 and 20 occur exceptionally.

Habits. "A strictly rupicolous species, not uncommon on boulder-strewn hills . . . These large gerrhosaurids are somewhat clumsy of movement, and never venture far from their rocky retreats. When alarmed they disappear into the nearest crack or crevice, where they lie low until all danger is past. It is often incredible the narrow openings into which these large lizards can squeeze; here they wedge themselves so securely that nothing can dislodge them save lifting of a rock." (FitzSimons, 1935b).

Localities. **Mozambique:** Chifumbazi; Old Enchopi; Tete. **Southern Rhodesia:** Changadzi River; Devuli River Bridge; Empandeni; Insiza; Mt. Silozi, Matopos Hills; Zimbabwe. **Transvaal:** Woodbush. **Orange Free State:** Sources of Orange River.

Range. Orange Free State, north through Transvaal to Southern Rhodesia and Mozambique.

Gerrhosaurus validus skoogi Andersson

1916. *Gerrhosaurus skoogi* Andersson, Med. Göteborgs Musei Zool. Afdel., 9, p. 10, fig. 2: Port Alexander, Angola.

Description. Head depressed, its length *from back of parietal only* being included in the distance from snout to anus 5.6 times (i. e. similar proportion to typical *validus* of this size whose head length, to behind ear, would be included in the distance from snout to anus 4.5 times); head shields smooth; rostral large, with sharp cutting edge, in contact with the frontonasal; prefrontals shortly in contact; supraoculars 4; supraciliaries 5; tympanic shield large, trapezoid; body almost cylindrical (obviously bloated); dorsals smooth anteriorly, feebly tricarinate and serrate posteriorly, in 35 longitudinal and 64 transverse rows; ventrals in 18–22 longitudinal rows; femoral pores 24–27 on each side; tail slightly shorter than the length of head and body (? reproduced).

The foregoing description is based on the original, which should be consulted for further details, for the race is known only from the unique type (Göteborg Mus. 1387) which I have not seen. The remarks in parenthesis above, have been added by me; for additional comments see footnote to the key on page 490. Should the race prove to be identical with *maltzahni* (1938), the name *skoogi* (1916) would have to take precedence.

Coloration. Above, head dusky; body grayish brown; margin of upper jaw, sides of neck, and forelimbs anteriorly, yet black; fore feet

white. Below, throat, breast and belly anteriorly black; middle and posterior portion of belly and underside of thighs, dusky.

Is it possible that this peculiar coloration is the result of bleaching, certain parts having been subjected to strong sunlight?

Size. Total length of type, 266 (136 + 130) mm.

Range. **Angola** (known only from type locality in southwest corner).

Gerrhosaurus validus maltzahni Grys

1862a. *Gerrhosaurus robustus* Peters (not Peters, 1854), p. 18.
1887a. Bocage, p. 203.
1869b. *Gerrhosaurus validus* Peters (not Smith), p. 659.
1895a. Bocage, p. 36.
1905e. Boulenger, p. 111.
1911d. Sternfeld, p. 35.
1929. Rose, p. 219.
1937b. Mertens, p. 8.
1937b. Monard, pp. 76, 77.
1938e. Mertens, p. 435.
1938. *Gerrhosaurus Maltzahni* de Grys, Zool. Anz., **124**, p. 58, figs. 1–2: Roidina Farm, South West Africa. (October 15, 1938).
1938. *Gerrhosaurus validus damarensis* FitzSimons, Ann. Transvaal Mus., **19**, p. 198, fig. 9: Paderburn Farm, South West Africa. (October 30, 1938).

Native name. Combe (at Quilengues: Anchieta).

Description. Head moderate, its length being included in the distance from snout to anus 4.7 (young) to 5 (adult) times; head shields smooth (young), feebly striated (halfgrown), or rugose (adult); rostral separated from the frontonasal; prefrontals broadly in contact; supraoculars 4; supraciliaries 5–6; subocular reaching lip; tympanic shield narrow and bandlike (young) or broad and subtriangular (adult); body cyclotetragonal or depressed; dorsals strongly keeled, unicarinate (young), tricarinate (halfgrown), or multicarinate (adult), and serrated, in 25–30 longitudinal and 50–55 transverse rows; laterals keeled and sometimes striated also; ventrals in 12[1]–14 longitudinal and 41–44 transverse rows from pectoral to anal shields; femoral pores 20–23 on each side; fourth toe with 15–22[2] lamellae below; tail 1.5 (young) to 1.8 (adult) times the length of head and body.

[1] 12 in paratypes of *damarensis, fide* FitzSimons.

[2] 15–17 in South West and 20–21 in two Mossamedes, Angola, lizards for whose count I am indebted to Mr. C. M. Bogert.

Coloration. Above, head buff or yellow blotched with brown; body and tail buff, each scale, except for a broad, light, dorsolateral band, so overlaid with black as to be almost obscured except for a light buff or yellow streak, such streaks forming interrupted longitudinal lines; limbs so overlaid as to appear black with light spots. Below, white or yellowish, chin, throat, and limbs sparsely streaked or blotched with russet or vinaceous brown; belly and tail appearing brownish as the white persists only as fine light longitudinal lines along the edges of the ventrals and caudals, on tail sometimes producing an annular effect of alternating brown and yellowish white.

Size. Total length of ♂, 549 (211 + 338) mm., from Paderburn Farm; of ♀, 587 (224 + 362) mm., from Erongo Mountain Plateau (M.C.Z. 43422), exceeded in length from snout to vent only by an Angolan lizard of 250 mm. (Boulenger, 1905c).

Remarks. G. maltzahni was based on a young (89 + 135 mm.) individual so that the characters employed for its separation—smooth head, narrow tympanic shield, unicarinate scales—are of only juvenile importance. For details of juvenile coloring, see de Grys' original description. The type locality is just north of Omaruru, Damaraland.

G. v. damarensis was described from an adult (211 + 238 mm.) and two paratypes, and it is hard on Mr. FitzSimons that it is preoccupied by only a fortnight, for he was the first to invite attention to the distinguishing subspecific characters utilized in my key, after checking them with the material of both races in the Museum of Comparative Zoölogy. I am indebted to Mr. FitzSimons for the date of publication and for information about both type localities, that of *damarensis* being less than a hundred miles northwest of that of *maltzahni*.

Should *skoogi's* description prove to be misleading and that form not distinguishable from *maltzahni*, then *skoogi* (1916) will have precedence for the western form of *validus*.

Breeding. In September, on Erongo Mountain Plateau, a ♀ (M.C.Z. 43422), held spherical eggs of 12 mm. diameter.

Habits. "Very shy and retiring, usually a single specimen found occupying an isolated outcrop of rocks; never observed on the larger koppies, seemingly preferring the small outcrops." (FitzSimons).

From such they make brief excursions in search of insects, if disturbed while so doing a dash is made for the nearest rocks; should these be more than twenty-five yards away the lizards may be readily captured for they soon tire and seem scarcely able to run the last few yards (Schoeman, in Rose).

Localities. **South West Africa:** Damaraland; Gobabis; Kamanyab; Neu Barmen; Paderburn Farm, Huab River; Roidina Farm, near Omaruru; Windhuk. **Angola:** Bihe to Quilengues; Cubal, Benguela; Mossamedes; Quilengues; Rio Chimba.

Range. South West Africa and Angola.

Gerrhosaurus major zechi Tornier

1901c. *Gerrhosaurus maior* var. *zechi* Tornier, Arch. Naturg., **67**, p. 74, figs. 1–3: Kete Kratje, Togoland.

1919. *Gerrhosaurus zechi* Schmidt, pp. 519, 601, fig. 21, map 16, pl. xx, fig. 2.

East African references to this form have been transferred to *G. m. bottegoi* Prato.

Description. Head moderate, its length being included in the distance from snout to anus 3.9 (young) to 4.8 (adult) times; head shields rugose; rostral in contact with, or separated from, the frontonasal; frontonasal divided; prefrontals broadly in contact or rarely separated; supraoculars 4; supraciliaries 5, rarely 3–4[1]; tympanic shield narrow, band-like; body cyclotetragonal or slightly depressed; dorsals strongly keeled, striated or rugose, in 18–20 longitudinal and 32–37 transverse rows; laterals keeled and striated; ventrals in 10 longitudinal and 33 transverse rows from pectoral to anal shields; femoral pores 12–15 on each side; fourth toe with 15 lamellae below; tail about 1.1 to 1.25 times the length of head and body.

Coloration. Above, head buff, each shield heavily overlaid with black; body and tail buff, but every scale on back so heavily overlaid with black that in common with the limbs and tail it presents the appearance of being black spotted with buff, the buff spots forming regular lines but no specially distinct dorsolateral line. Below, chin and throat white; limbs whitish; belly and tail brownish with indistinct fine, light, longitudinal lines along the edges of the ventrals and subcaudals.

Size. Total length of ♂, 455 (203 + 252) mm., of ♀, 302 (129 + 173) mm., both from Garamba. The smaller cotype measured 165 (76 + 89) mm.

Remarks. Known only from the two young cotypes in the Berlin Museum and the three Congo specimens reported on by Schmidt, one of which has been available to me for the present studies. This western

[1] 3, 4, and 5 in the two cotypes, *fide* Tornier.

race is undoubtedly slightly darker than the eastern *bottegoi*. Additional details will be found in both papers cited above.

Diet. Crickets, carabids, and polydesmids (Lang, in Schmidt).

Habits. Lang speaks of "their liveliness and boldness of pose as they watch an intruder." When pursued they rush for their burrows in the hard ground, which burrows, he considers, they themselves dig during the rainy season. Despite the smallness of the aperture they enter with surprising speed, dashing down a passage several feet in length to a spacious chamber about a foot below the surface. He found them difficult to remove for they not only clung to the sides with their strong claws but inflated their bodies. Though very flexible, the heavy tail is discarded when any restraint is put upon it. On being captured they bit and scratched and, when roughly handled, feigned death. "When freed on level ground they have the peculiar habit of running a distance and suddenly halting, sometimes with tail raised, as shown in plate xx, figure 2. This trait, of course, practically protects them from further pursuit when cover has been reached, especially as they remain so quiet that one is likely to tread upon them." (Lang, in Schmidt).

Habitat. Arid savanna.

Localities. **Togo:** Kete Kratje. **Belgian Congo:** Garamba.

Range. Togo to northern Belgian Congo.

Gerrhosaurus major bottegoi Prato

1895. *Gerrhosaurus Bottegoi* del Prato, Atti Soc. Ital. Sci. Nat., **35**, p. 19, figs. 1–1a: Valley of Ghinda, Eritrea.
1910a. Hewitt, p. 62.
1930a. Scortecci, p. 207.
1931b. *Gerrhosaurus major* Scortecci (not Duméril), p. 146.
1929h. *Gerrhosaurus major zechi* Loveridge (not Tornier), p. 66.
1933h. Loveridge, p. 311.
1936h. Loveridge, p. 64.
1937f. Loveridge, p. 495.
1937d. Mertens, p. 5.

Native name. Kiuhotei (Sandawi).

Description. Head moderate, its length being included in the distance from snout to anus 4 (young) to 5.2 (adult) times; head shields rugose; rostral rarely in contact with[1], usually separated from[2], the

[1] Meeting in a point in one (M.C.Z. 30849) only of 23 Mangasini lizards.

[2] In type by a small azygous scale such as has been described in a *G. m. major* by Tornier (1901c, p. 76).

frontonasal; frontonasal much subject to subdivision though often entire; prefrontals broadly in contact; supraoculars 4; supraciliaries 5, rarely 4 or 6; tympanic shield narrow, band-like; body cyclotetragonal or slightly depressed; dorsals strongly keeled, striated or rugose, in 17–20 longitudinal and 33–36 transverse rows; laterals keeled and striated; ventral in 10 longitudinal and 32–34[1] transverse rows from pectoral to anal shields; femoral pores 10–17 on each side; fourth toe with 13–17 lamellae below; tail about 1.25 to nearly 1.5 times the length of head and body.

Coloration. Above, head buff, each shield flecked with black; body and tail buff, almost every scale heavily streaked with black thus forming regular lines on the whole back so that in common with the flanks, limbs, and tail, it presents the appearance of being brown or black spotted with buff; from back of head to lumbar region a more or less distinct yellowish dorsolateral line. Below, chin and throat white; limbs whitish; belly and tail brownish with fine, light, longitudinal lines along the edges of the ventrals and subcaudals.

Salimu, a native collector who was familiar with these lizards, reported seeing one at Luguo which had a bright red belly; it was dead but the color was not due to putrefaction.

Size. Total length of ♂, 501 (205 + 296) mm., surpassed by a larger unsexed specimen of 545 (225 + 320) mm., both from Mangasini.

Diet. Everyone of 23 Mangasini lizards examined had fed on termites, which happened to be flighting at that time.

Parasites. Tapeworms (*Oochoristica zonuri*) and threadworms (*Physaloptera* sp), present in the Mangasini series.

Habitat. At Dodoma and Mangasini among the piled-up rock masses of the kopjes which are scattered like so many islands among a sea of thorn-bush steppe. As our arrival at Mangasini coincided with the breaking of the rains, and consequently the flighting of termites, the reptiles were probably more in evidence than at other seasons. To shoot them would have shattered their fragile tails, our attempts to capture them merely made us feel foolish, for the creatures retreated under their ledges where they were out of reach, and some of the more gorged individuals then lay and looked at us. I explained the position to the small Wasandawi boys who, with the aid of their dogs and padded arrows, promptly secured a series of thirty in little more than twenty-four hours.

[1] Type stated to have 37, probably due to inclusion of pectorals.

Localities. **Tanganyika Territory:** Dodoma; Lake Eyasi to Usansu; Luguo (seen, ? race); Mangasini. **Kenya Colony:** (U.S.N.M. 42216). **Italian Somaliland:** Villaggio Duca degli Abruzzi. **Ethiopia:** Bisan River. **Eritrea:** Ghinda Valley.

Range. Central Tanganyika Territory north through western (?) Kenya to Italian Somaliland, Ethiopia and Eritrea.

Gerrhosaurus major grandis Boulenger

1908b. *Gerrhosaurus grandis* Boulenger, Ann. Natal Mus., **1**, pp. 225–233, pl. xxxvi: Zululand.
1910b. Boulenger, p. 480.
1910a. Hewitt, p. 62.
1928. Cott, p. 953.
1931. Mann, pp. 389, 397, 399, 401.
1937a. Flower, p. 27.
1939b. FitzSimons, p. 34.
1910c. *Gerrhosaurus major* Hewitt (not Duméril), p. 104.
1920a. Loveridge (part), p. 149.
1934a. Cott, p. 165.
1910c. *Gerrhosaurus major grandis* Hewitt, pp. 102, 105.
1935. Lawrence, p. 44.

Description. Head moderate, its length being included in the distance from snout to anus 4 (young) to 4.7 (adult) times; head shields rugose; rostral in contact with, or separated from, the frontonasal; prefrontals broadly in contact; supraoculars 4; supraciliaries 5; tympanic shield narrow, band-like; body cyclotetragonal or slightly depressed; dorsals strongly keeled, striated or rugose, in 16–18 (20[1]) longitudinal and 32–36 transverse rows; laterals keeled and striated in 10 longitudinal and 30–32 (33[1]) transverse rows from pectoral to anal shields; femoral pores 10–13 on each side; fourth toe with 12–14 (15[1]) lamellae below; tail 1.3 to 1.5 times the length of head and body.

Coloration. Above, head uniformly buff, body and tail buff with dark brown or black streaks or spots which tend to form regular lines on the back but coalesce posteriorly so that the flanks, limbs, and tail are brown or black spotted with buff; from back of head to lumbar region a more or less distinct yellowish dorsolateral line. Below, chin and throat white; limbs whitish; belly and tail brownish with, or without, fine light, longitudinal lines along the edges of ventrals and subcaudals.

[1] Figures in parenthesis are those of a Morogoro male (A.M.N.H. 13864).

The coloring of iris and pupil is described by Mann (1931).

Size. Total length of largest, 476 (218 + 258) mm., from Birchenough (FitzSimons), but one might suspect that the tail is regenerated for the type measured 475 (190 + 285) mm.

Remarks. Hewitt (1910a) synonymized *grandis* with *major*, but later (1910c) raised it to varietal rank, or subspecies as now understood.

Breeding. On July 10, at Amatongas, a ♀ held 9 round ova measuring about 6 mm. in diameter (Cott).

Longevity. 7 years, 2 months, 5 days (Flower),

Diet. At Morogoro a captive specimen seized and ate a lizard (*Eremias s. spekii*) which shared its cage.

Parasites. Mites (*Pterygosoma gerrhosauri*) were found by Lawrence.

Habitat. At Morogoro, where this southern race meets with the typical coastal form, these big lizards dwelt among the jumbled rocks which flank the river in its upper reaches. Further south they occur on kopjes and isolated boulder outcrops (FitzSimons).

Localities. **Zululand:** Ubombo. **Transvaal:** Griffin Mine near Leydsdorp; Hectorspruit; Kaapmuiden, Barberton district; Malalane, Barberton district. **Southern Rhodesia:** Birchenough Bridge to Changadzi River. **Northern Rhodesia:** Feira district near Zambezi. **Mozambique:** Amatongas. **Tanganyika Territory:** Morogoro.

Range. Zululand and Transvaal north to east central Tanganyika Territory.

Gerrhosaurus major major Duméril

1851. *Gerrhosaurus Major* A. Duméril, Cat. Méth. Coll. Rept., p. 139: Zanzibar.
1854. Peters, p. 618.
1855. Peters, p. 47.
1866b. Peters, p. 888.
1869a. Peters, p. 15.
1878a. Peters, p. 203.
1882a. Peters, p. 58.
1887a. Boulenger, p. 121.
1888. Mocquard, p. 118.
1893. Pfeffer, p. 74.
1895. Prato, p. 20, fig. 2.
1896. Tornier, p. 41 (as *maior*).
1897. Tornier, p. 64 (as *maior*).
1900b. Tornier, p. 593 (as *maior*).
1901c. Tornier, p. 76.
1902b. [1]Tornier, p. 582.
1907a. Boulenger, p. 8.
1910a. Hewitt, p. 62.
1910c. Hewitt, pp. 102, 104, 105.
1910. Meek, p. 409.
1911b. Hewitt, p. 49.
1911a. Sternfeld, p. 247.
1911c. Sternfeld, p. 417.
1913c. Nieden, p. 79.
1920a. Loveridge (part), p. 149.
1923d. Loveridge, p. 856.
1923h. Loveridge (? part), p. 954.
1924b. Loveridge, p. 12.
1929h. Loveridge, p. 66.
1889. *Gerrhosaurus zanzibaricus* Pfeffer, Jahrb. Hamburg. Wiss. Anst., **6**, p. 7: Zanzibar.
1906a. *Gerrhosaurus bergi* Werner, Zool. Anz., **30**, p. 54, figs. 1–3: Usambara Mountains, Tanganyika Territory.
1910a. Hewitt, p. 62.
1911. Lönnberg, p. 15.
1933h. *Gerrhosaurus major major* Loveridge, p. 311.
1934. Pitman, p. 305.
1936h. Loveridge, p. 64.
1936j. Loveridge, p. 308.
1937f. Loveridge, pp. 493, 495.
1941. Moreau & Pakenham, p. 108.

[1] Possibly referable to *G. m. bollegoi*.

Further citations of '*major*' will be found under the races *grandis* and *bottegoi*.

Native name. *Guruguru* (Zanzibar: Peters); *guguru* (*Kami:* Loveridge.

Description. Head moderate, its length being included in the distance from snout to anus 4.1 (young) to 5.1[1] (adult) times; head shields rugose; rostral in contact with, or separated from, the frontonasal; frontonasal divided, rarely entire; prefrontals broadly in contact; supraoculars 4, rarely 3; supraciliaries 5, rarely 3–4; tympanic shield narrow, band-like; body cyclotetragonal or slightly depressed; dorsals strongly keeled, striated or rugose, in 17–21[2] longitudinal and 32–38 transverse rows; laterals keeled and striated; ventrals in 10, rarely 9[3] longitudinal and 31–34 transverse rows from pectoral to anal shields; femoral pores 12–14; fourth toe with 13–16 lamellae below; tail 1.25 to 1.5 times the length of head and body.

Coloration. Above, uniform fulvous brown or buff. Below, uniform yelllowish white.

Individuals occur, however, even on Zanzibar, which show slight traces of black on the keels and even form ill-defined dark lines on lumbar region and tail. *G. zanzibaricus* was based on such a lizard. Mocquard (1888, p. 118) mentions three specimens from Zanzibar of which two had body scales spotted with black. Presumably this was slight, but if not, as part of his collection came from Somaliland the data may be questionable. Tornier (1902c) refers to a young lizard from the Pare Mountains which 'almost certainly had yellow flecks on a dark ground' (translation), I am uncertain, therefore, whether this specimen should be referred to *G. m. bottegoi* or whether it implies that young *major* revert to the ancestral pigmentation in some instances.

Peters (1882a) states that in life the loreal region is rusty red; the lips, auricular border, and lateral folds gray-blue; skin between scales bluish; chin and throat orange yellow; rest of undersurface dirty white.

Size. Total length of ♂, 555 (240 + 315) mm., from Lumbo; total length of ♀, 518 (206 + 312) mm., from Voi.

Remarks. The occipital scale may be present or absent (Pfeffer). Indeed so much variability is displayed by the head shields that no

[1] 5.3 times in type of *bergi*, *fide* Werner (1906).

[2] 12 given by Meek is an error for 18, *fide* Loveridge (1936h); 22 *fide* Tornier (1901c)

[3] 12 in type of *zanzibaricus* is almost certainly an error.

useful purpose can be served by repeating them or attempting to enlarge the description to cover them. Some have been noted by Tornier (1901c, pp. 76–81), others by me (1920a, 1929h), and many more will be found in the literature.

Breeding. On April 10, at Voi, a ♀ held a single developing 14 mm. ovum in addition to numerous smaller ova. In the Zanzibar Museum is an egg measuring 75 x 40 mm., together with an emergent lizard of 208 (95 + 113) mm.[1]

Diet. Leg of a beetle together with some small beans and grass were found in the stomach of one lizard.

Parasites. Ticks (*Aponomma ochraceum*)[2], previously known only from a Zanzibar skink (*Mabuya striata*) were plentiful on Zanzibar lizards. Tapeworms (*Oochoristica zonuri*) each about a foot long were removed from a Lumbo lizard, and threadworms (*Physaloptera* sp.) from a Voi specimen.

Habitat. At Voi a female was disturbed while basking in dense scrub whereupon she sought refuge among drifted leaves in a rock fissure. In rock-free, orchard savanna near Kilosa one was seen to emerge from a smoke-filled hollow log around which a bush-fire had been raging for fully five minutes. At Lumbo where termite hills are a feature of the rock-free, dry-bush country, giant greaved lizards dwelt in the passages of the termitaria, on one occasion a lizard was found huddled together with two mongoose (*Helogale ivori*) in the same cavity.

Localities. **Mozambique:** Chifumbazi; Lumbo. **Zanzibar:** Kibweni. **Tanganyika Territory**[3] Kilosa (seen); Kipera (seen); Mikindani; Mkindo River (seen); Morogoro (? loc.); Mount Kirui (seen); Mwanza (seen); Pare Pesa, Pare Mtns. (? *bottegoi*); Ulugu (seen); Usambara Mtns. **Kenya Colony:** Ithanga Hills; Lukenya Hills; Maji ya Chumvi; Mazeras; Merelle River; Mt. Mbololo; Mt. Sagalla; Njoro; Sokoki; Takaungu (Takannuga); Teita; Voi; Yatta Plains.

Range. Coastal regions of Mozambique, Tanganyika, and Kenya Colony, also Zanzibar Island.

[1] I am indebted to the curator, Miss E. N. Smith, for these measurements.

[2] Identification by Prof. J. Bequaert.

[3] The Tanga record of Tornier was subsequently corrected to Zanzibar. Some of the sight records may possibly belong to *G. m. bottegoi*.

Gerrhosaurus typicus (Smith)

1836. *Pleurotuchus typicus* A. Smith, 1837, Mag. Zool. Bot. (Jardine), **1**, p. 143: Sandy plains immediately south of mouth of Orange River, South Africa.
1839. *Gerrhosaurus typicus* Duméril & Bibron, p. 383.
1844. Smith, pls. xxxviii, fig. 2, and xlii, figs. 5–8.
1887a. Boulenger, p. 123.
1898. Sclater, p. 105.
1907b. Roux, p. 429.
1910b. Boulenger, p. 480.
1910a. Hewitt, p. 62.
1910c. Hewitt, pp. 103, 105.
1910a. Werner, p. 340.
1911d. Sternfeld, p. 36.
1935a. FitzSimons, p. 544.
1935. Lawrence, p. 44.
1937a. FitzSimons, p. 268.
1940. Malan, p. 192, figs.

Native name. Ourukaima-aap (Hottentot: Smith).

Description. Head small, its length being included in the distance from snout to anus 5 to 5.2 (adult) times; head shields smooth; rostral in contact with, or narrowly separated from, the frontonasal; prefrontals slightly separated or barely in contact; supraoculars 4; supraciliaries 5; tympanic shield broad, crescentic; body cyclotetragonal or slightly depressed; dorsals strongly keeled, not striated, in 22–24 longitudinal and 56–58 transverse rows; laterals smooth; ventrals in 10 longitudinal and 30–35 transverse rows from pectoral to anal shields; femoral pores 15–17 on each side; fourth toe with 16–18 lamellae below; tail about 1.25 to 2 times the length of head and body.

Coloration. Above, head, back, and tail deep olive brown; a broad, light yellow, dorsolateral line, dark-edged above, from head to tail anteriorly; flank dark brown with a double series of dark-edged, white (yellow) spots; a similar, but less distinct, series on the tail. Below, creamy white (yellowish); "underside of limbs and distal half of tail carrot-red in adult males." (FitzSimons). Eyes orange brown.

Size. Total length of a cotype, 290 (100 + 190) mm., surpassed by a Klipfontein lizard measuring 320 (140 + 180) mm. (Werner).

Remarks. For discussion on types, see FitzSimons (1937a).

Anatomy. The cranium is discussed by Malan (1940).

Parasites. No mites were found on this species by Lawrence (1935).

Habits. Shy and elusive, venturing abroad only in the early morning

and late afternoon (FitzSimons), when disturbed, darting with great rapidity, they seek refuge in burrows in the sand accumulated about the base of shrubs (Smith).

Localities. **Cape Province:** Namaqualand: Klipfontein; Lekkersing; Soebartsfontein; south of mouth of Orange River; Steinkop.

Range. Little Namaqualand, Cape Province.

Gerrhosaurus nigrolineatus auritus Boettger

1887b. *Gerrhosaurus auritus* Boettger, Ber. Senckenb. Ges. Nat., p. 148, pl. v, figs. 3a–3d: Ondonga, Ovamboland, South West Africa.
1893a. Boettger, p. 94.
1910b. Boulenger, p. 480.
1910c. Hewitt, pp. 103, 104, 105.
1911b. Hewitt, p. 50.
1911d. Sternfeld, p. 36, fig. 44.
1920b. Angel, p. 616.
1922a. Mertens, p. 174.
1935b. FitzSimons, p. 363.
1935. Lawrence, p. 44.
1937b. Monard, pp. 77, 78.

Description. Head moderate, its length being included in the distance from snout to anus 4.8 to 5 times (adults); head shields smooth; rostral separated from the frontonasal; prefrontals broadly in contact; supraoculars 4; supraciliaries 4; tympanic shield broad, crescentic; body cyclotetragonal; dorsals strongly keeled but not striated, in 26 longitudinal and 50–57 transverse rows; laterals feebly keeled in young, smooth in adults; ventrals in 8 longitudinal and 32–34 transverse rows from pectoral to anal shields; femoral pores 14–16 on each side; fourth toe with 16–18 lamellae below; tail once and a half to nearly twice the length of head and body.

Coloration. Adult. Above, light sepia brown; head and body flecked and spotted with darker; three or four dark-edged, whitish, dorsolateral lines from head to tail anteriorly; flanks pale with irregular pinkish infusions and spotted with dark sepia; limbs with large, dark-edged, yellowish spots. Below, creamy white.

Young. Above, sepia; vertebral region with three series of white-centered, darker spots of which the median is largest; a narrow, dark-edged, whitish, dorsolateral line from head to tail anteriorly; flanks pale brownish with a series of vertical yellowish white spots (adapted from FitzSimons).

Size. Total length of a Kalahari lizard, 394 (146 + 248) mm., perhaps a composite as lengths are given separately by FitzSimons (1935b) whose paper should be consulted for detailed dimensions, averages, etc.

Remarks. Most of our knowledge of this race is due to FitzSimons, one of whose nine specimens (M.C.Z. 33493) has been available to me.

Diet. Beetles, grasshoppers, termites, and a centipede (*Scolopendra morsitans*) were found in stomachs examined by FitzSimons.

Parasites. Mites (*Pterygosoma bicolor*) found by Lawrence; nematodes by FitzSimons.

Habitat. These were the only members of the genus encountered throughout the Kalahari sand veld by FitzSimons, who considers that they showed a marked preference for those areas where *Terminalia* scrub flourished and beneath whose undergrowth they had their burrows. Owing to their pale color and habit of remaining quiescent until closely approached, they were difficult to detect and capture.

Localities. **South West Africa:** Omondonga (Ondonga), Ovamboland. **Bechuanaland:** Damara Pan; Damara Pan to Okwa River; Gemsbok; Kalahari; Kaotwe; Kwaai; Mabeleapudi. **Northern Rhodesia:** Lialui (Lealui, *fide* Angel). **Angola:** Lunda (*fide* Monard).

Monard's remarks would make it appear that his record is reliable, his suggestion that this race may be a synonym of *multilineatus* Bocage is definitely rejected. Both Lunda and Lialui (Angel furnishes no remarks which might serve as a check), however, are much further north than one would expect this deserticolous form to have penetrated.

Range. Sand veld areas of South West Africa and Bechuanaland (possibly north to Angola and Northern Rhodesia).

Gerrhosaurus nigrolineatus nigrolineatus Hallowell

1857. *Gerrhosaurus nigro-lineatus* Hallowell, Proc. Acad. Nat. Sci. Philadelphia, p. 49: Gaboon.
1866a Bocage, p. 43.
1876a. Peters, p. 118.
1877c. Peters, p. 613.
1887a. Bocage, p. 210.
1887a. Boulenger, p. 122.
1888a. Boettger, p. 25.
1889. Pfeffer, p. 8.
1892. Müller, p. 213.
1892a. Siebenrock, p. 165, pl. ii, figs. 7–7b.
1893a. Boettger, p. 95.
1893. Pfeffer, p. 74.
1893. Prato, p. 9.
1895a. Bocage, p. 35.
1895a. Siebenrock, p. 22.
1896b. Bocage, p. 111.
1896. Tornier, p. 42.
1897b. Mocquard, p. 8.
1897c. Mocquard, p. 123.
1897. Tornier, p. 64.
1898. Tornier, p. 286, fig. 5.
1900b. Boulenger, p. 449.
1900. Ferreira, p. 49.
1902a. Scherer, p. 254.
1902a. Werner, p. 342.
1903a. Ferreira, p. 15.
1904. Ferreira, p. 117.
1905c. Boulenger, p. 111.
1906i. Boulenger, p. 204.
1906a. Mocquard, p. 604.
1907a. Boulenger, p. 8.
1907. Lönnberg, p. 6.
1910b. Boulenger, p. 480.
1911b. Hewitt, p. 49.
1912c. Sternfeld, p. 224.
1919g. Boulenger, p. 16.
1923d. Angel, p. 159.
1923d. Loveridge, p. 856.
1923h. Loveridge (part), p. 955 (omit Frere Town).
1924b. Loveridge, p. 12.
1927d. Witte, p. 328.
1928. Angel, p. 248.
1931. Monard, p. 98.
1931. Power, p. 48.
1933m. Witte, p. 75.
1934. Pitman, p. 305.

1937b. Monard, pp. 77, 78.
1938. Gorham & Ivy, p. 180.
1866a. *Gerrhosaurus multilineatus* Bocage, Jorn. Sci. Lisboa, **1**, p. 44: Duque de Bragança, Angola.
1866b. Bocage, p. 61.
1867a. Bocage, p. 221.
1881d. Peters, p. 147.
1896. *Gerrhosaurus flavigularis* Tornier (not Wiegmann), p. 42.
1897. Tornier, p. 64.
1900b. Tornier, p. 593.
1902b. Tornier, p. 583.
1907. Lönnberg, p. 6.
1909a. Chubb, p. 594.
1909b. Chubb, p. 35.
1910. Meek, p. 409.
1911a. Sternfeld, p. 247.
1911d. Sternfeld (part), p. 35, fig. 43. (omit Kokong).
1913c. Nieden (part), p. 80 (omit Teita).
1915c. Werner, p. 347.
1917. Sternfeld, p. 428.
1920a. Loveridge (part), p. 150 (omit Lumbo).
1923b. Calabresi, p. 157.
1927c. Power, p. 408.
1907. *Gerrhosaurus flavigularis* forma *intermedia* Lönnberg, in Sjöstedt, Wiss. Ergebn. Schwed. Zool. Exped. Kilimandjaro Meru umgeb Massaisteppen, No. 4, p. 7, pl. i, figs. 1a–b: Steppe near Lake Natron, Tanganyika Territory.
1923d. Loveridge, p. 856.
1924b. Loveridge, p. 12.
1919. *Gerrhosaurus flavigularis nigrolineatus* Schmidt, p. 523.
1926a. Mertens, p. 152.
1933. Schmidt, p. 11.
1935b. FitzSimons, p. 365.
1935. Lawrence, p. 44.
1936h. Loveridge, p. 65.
1936c. Parker, p. 133.
1937f. Loveridge, p. 495.
1937b. Mertens, p. 8.
1938. FitzSimons, p. 198.
1938e. Mertens, p. 435.
1919. *Gerrhosaurus flavigularis flavigularis* Schmidt (part), p. 519.
1928d. Loveridge, p. 65.
1929h. Loveridge (part), p. 67 (omit Mazeras, Sagalla, Voi).
1933h. Loveridge, p. 312.
1936h. Loveridge, p. 64.
1937b. Mertens, p. 8.
1939a. *Gerrhosaurus nigrolineatus australis* FitzSimons, Ann. Transvaal Mus. **20**, p. 10: Kaapmuiden, eastern Transvaal.
1939b. FitzSimons, p. 35.

Further citations of '*nigrolineatus*' will be found under *f. flavigularis*. Rochebrune's (1884a) is ignored for reasons explained in the introduction.

Native names. *Cangala* or *cangala njambe* (at Catumbela: Bocage); *intyili* (Ngangela: Monard); *rikalanga* (at Cazengo, etc.: Ferreira); *ligondo* (Yao); *liwalawahi* (Makonde at Kitaya); *nangkwakata* (Makonde at Mbanja); *sampula mhange* or *sangarazi* (Kami).

Description. Head moderate, its length being included in the distance from snout to anus 3.25 (hatchlings) to 5 (adult) times; head shields smooth; rostral separated from, rarely in contact with, the frontonasal; prefrontals usually broadly in contact, sometimes barely, very rarely separated; supraoculars 4; supraciliaries 4, very rarely 3 or 5[1]; tympanic shield moderate or broadly crescentic; body cyclotetragonal; dorsals strongly keeled, usually striated, sometimes smooth except for keels, in 20–26 (or 28[2]) longitudinal and 52–60 transverse rows; laterals striated, keeled, or more or less smooth; ventrals in 8 longitudinal and 32–36 transverse rows from pectoral to anal shields; femoral pores 12–21 on each side; fourth toe with 14–18 lamellae below; tail 2.3 to 2.5 times the length of the head and body.

Coloration. Above, head brown or yellowish, uniform or mottled with darker; a dark-edged, white, or pale lemon yellow, dorsolateral line from supraocular region to tail anteriorly; vertebral region olive to brown, usually each scale spotted with darker; rarely a dark-edged, pale, vertebral line, more usually broken up into a series of pale, sometimes dark-edged, dashes or spots, or each dorsal scale streaked with black so as to form a series of dark lines (*multilineatus*); flanks light olive to sandy brown, uniform or flecked with white, yellow, sometimes red, or black, which in the young often form light vertical bars; limbs uniform or with dark-edged, pale spots. Below, uniform yellowish or white.

In life. ♂. Kilosa. Above, nut brown; a vertebral and a pair of dorsolateral lines are yellow edged with black, between these lines are longitudinal series of black spots; sides scarlet with vertical stripes formed by alternating brown and yellow scales. Below, pure white.

Size. Total length of ♂, 467 (170 + 297) mm. from Mangasini, but surpassed by the type of *australis*, also a ♂, 485 (163 + 322) mm.

[1] 3 in an Ndallo Tando lizard (M.C.Z. 7435), 5 in three specimens from Moshi (M.C.Z. 18316), Dar es Salaam (M.C.Z. 18318), and Mbanja (M.C.Z. 47428) respectively.

[2] In the voluminous literature Schmidt (1919) alone records 28, which Bogert, after examining Schmidt's material, suggests may possibly be due to inclusion of scarcely developed scales on the flanks. See note under *Remarks*.

from Kaapmuiden, Transvaal; Werner's (1910a) record of 475 (140 + 335) mm. from Nitdraai, South West Africa, or Boettger's (1888a) record of 471 (153 + 318) mm. from Povo Nemlao, Belgian Congo.

Remarks. Head shields in this species are subject to considerable variation and the literature is full of discussions regarding them. Schmidt (1919) comments on certain anomalies in his Congo-Angolan material. Parker (1936c) remarks that the frontals are shorter in his Angolan specimens than are those in lizards from South West Africa. FitzSimons (1938) states that the frontonasal was as long as broad in thirteen South West Africa lizards, longer than broad in three others; in the type of *australis* it is broader than long but varies both ways in the paratypes. It is probably an age character. The degree of striation is highly variable though on the whole it may average rather more in western than in eastern specimens.

The number of dorsals across the back has been much discussed. In West Africa they number 24–26, the latter being common, but Schmidt (1919) gives 28 also, by inclusion of scarcely differentiated laterals. In East Africa dorsals range from 20–26 (I have taken several with the latter number at Kitaya within sight of the Indian Ocean) though usually 22–24; north and south of the equatorial belt, however, there is a tendency to reduction so that 20–22 is normal in the highlands of Kenya and northern Tanganyika (*intermedius*) and again in the Transvaal (*australis*). So great is the overlap that I find it impossible to separate an eastern race, much as I should like to do so. Neither can I find—as between eastern and western lizards—any difference in the number of femoral pores, lamellae under fourth toe, or in size (which see).

Nieden's (1913, p. 509) conclusions about head length are vitiated by his method of measuring only to the back of the parietals instead of to behind the tympanum. Under any circumstances the remarks of Tornier, Sternfeld and Nieden, when writing of *flavigularis* or *nigrolineatus* were based on a confusion of both. It was this hopeless state of the literature which led Schmidt, with evident misgivings, to suggest that all eastern and southern lizards should be called *G. f. flavigularis*, a suggestion followed by most of us until FitzSimons straightened the matter out to some extent.

Anatomy. Siebenrock (1892a, 1895a) deals with the cranium and sacrum respectively. More recently Gorham and Ivy (1938) have discussed the function of the gall bladder.

Breeding. There would appear to be a definite season in the coastal region of Tanganyika Territory, for on January 4, at Morogoro, a ♀

held 4 eggs measuring 21 mm. long, while on June 2, at Lindi, the ovules were small.

On March 25, at Kitaya, six eggs were found beneath a pile of rotting vegetation; on opening one egg I found an embryo so small that I placed the remaining five in a tin of damp sand and grass. During the succeeding months the eggs were examined periodically, and one egg which had dried up was discarded. On opening the tin on June 8 I found three lizards so recently emerged that the albumen upon them was still moist. I measured one of them and found it was 181 (56 + 125) mm., but after two years in preservative only 170 (53 + 117) mm.

Since it was collected in March, the remaining egg seemed to have swollen somewhat, it now measured 30 x 22 mm. In anticipation of a long wait I sat down with the egg lying on my palm. Almost immediately, however, there was a convulsive movement and a long slit appeared at one end of the parchment-like shell; about one minute later the little lizard's snout (up to and including the eyes) was thrust out; another minute elapsed and then the rest of the head appeared. For seven minutes thereafter nothing more occurred, then the forepart up to the hind legs crawled out, to be followed, a couple of minutes later, by the long tail. The little creature lay breathing heavily on my hand and offered no objection to being picked up and placed upon the table. Suddenly, with the unexpectedness which characterized most of its actions, and as if a fall of two and a half feet was of no account, it leaped to the ground and raced away with a fine turn of speed. I let it go. The whole emergence had taken place between 10.45 and 11.10 a.m.

On March 17, at Moshi; April 28, at Mbanja; May 8, at Kiponda; May 9, at Nchingidi; June 2, at Lindi; June 20, at Amboni near Tanga; and June 24, at Dar es Salaam, young, within half-a-dozen millimetres of the measurements of the hatchlings mentioned above, were encountered.

Diet. Grasshoppers form the staple food, but termites, beetles, ants, a spider, and even a snail (*Ennea*) have been found in their stomachs. I have taken an adult lizard in a snap-back rat trap baited with meat, but it may be assumed that the lizard had been attracted by insects on the bait. One *nigrolineatus* attempted to take a lizard (*Eremias s. spekii*) away from a larger relative (*Gerrhosaurus m. grandis*) which was engaged in eating it.

Parasites. Mites (*Pterygosoma bicolor*) have been found on this species by Lawrence, and a tick was taken from the throat of a Mangasini lizard.

Enemies. In Tanganyika I have recovered young specimens from the stomachs of a harrier (*Circus macrourus*), hawk (*Kaupifalco monogrammica*) kingfisher (*Halcyon a. orientalis*), house snake (*Boaedon l. lineatus*), wolf snakes (*Lycophidion c. capense*) and an adult, 457 mm. long, from a sand snake (*Psammophis s. sibilans*).

Habitat. In East Africa this shy and elusive lizard lives principally in dry bush country where the sparse grass permits it to dart to its burrow at the first sign of danger. At Kilosa, on several successive days, I observed one of these lizards, a fine male, disappear into a burrow at the base of a bush. It had come to occupy the burrow but recently for I passed the spot four times daily, indeed my attention had been first attracted to the spot by a little heap, or slide, of earth at the entrance, as if the lizard had cleaned the burrow before occupying it. I instructed Salimu to make a snare at the entrance and twice the lizard was caught but wriggled free. The laborious process of digging it out was therefore resorted to and the burrow found to be over a yard in length with two smaller blind alleys opening off it.

In South Africa, according to FitzSimons, the black-lined lizard occupies deserted meerkat burrows in open bush country adjacent to stony kopjes.

Localities. **French Congo:** Cape Lopez; Dongila; Fernand Vaz; Gaboon; Lambarene. **Belgian Congo:** Banana; Boma; Butu-Polo; Ganda-Sundi; Kabala; Kabelwe; Kiambi; Kimuenza; Kinshasa; Kisala; Kunungu; Leopoldville; Moanda; Ngombe; Povo Nemlao; Stanleyville; Zambi. **Cabinda:** Cabinda; Chinchoxo; Landana. **Angola**[1]**:** Ambriz; Benguela; Bimbi; Cabiri; Caconda; Cahata; Capangombe; Capelongo (Kapelongo); Caquindo (Kakindo); Carangigo; Catengue (? Katenge); Catumbela; Cazengo; Chimporo; Chitau; Congulu; Cubal; Cubango (Kuvangu); Cuma; Dondi—Missao de; Dondo; Duque de Bragança; Galangue (Galanga); Gauca; Hanah; Huilla; Kampulu; Kwito region, affluent of Cubango; Malange; Mulondo; Ndala Tando; Pungo Ndongo; Quilengues; Quindumbo; Quirimbo; Quissange; Rio Dande; Rio Mbale; Santo Amaro; Santo Antonio; Vila de Ponte. **South West Africa:** Gobabis; Kamanyab; Kaokoveld; Nitdraai; Okapehuri Farm near Okasise; Oshikango; Sissekab; Tsumeb (Usumeb); Windhuk. **Bechuanaland Protectorate:** Kabulabula; Kasane; Lobatsi; Serowe. **Orange Free State:** Smithfield. **Transvaal:** Blyde River; Hectorspruit; Kaapmuiden,

[1] In Angolan place names where there is a choice as between the Portuguese 'C' or 'Q' and the French 'K', the former are given preference, similarly single consonants are given preference over double, i.e. Benguela instead of Benguella.

Ottoshoop; Perkoe Farm near Olifants River; Salati. **Southern Rhodesia:** Bulawayo; Changadzi River; Empandeni Hunyanyi River; Victoria Falls. **Northern Rhodesia:** Lavushi Hills; Petauke; Ulungu Mtns. **Tanganyika Territory:** Bagamoyo (seen); Bukoba; Dar es Salaam; Gonya (seen); Handeni (seen); Ikikuyu; Kakoma; Kibonoto; Kidai; Kilosa; Kitaya; Korogwe; Lindi; Makonde Highlands; Mangasini; Marangu; Mbala; Mbanja; Mohoro; Morogoro; Moshi; Mukwese (seen); Nchingidi; Ngare na Nyuki; Pongue in Usegua; Saranda (seen); Tanga; Tendaguru Mtns.; Ukerewe Id. **Kenya Colony:** Fort Hall; Mt. Kenya—near; Nairobi; Wambugu.

Both *G. n. nigrolineatus* (recorded as *australis*) and *G. f. flavigularis* definitely occur together at Changadzi River (FitzSimons), and have been reported to do so at Serowe (Hewitt), and at Ngare na Nyuki (Lönnberg), though the latter, if correct, would be the East African race *fitzsimonsi*. Certainly I found both *n. nigrolineatus* and *f. fitzsimonsi* in the vicinity of Morogoro.

Range. South West Africa north to the French Congo, east to the highlands of central Kenya Colony, south to the Orange Free State.

Folklore. Believed by the Kami of Morogoro to strip bean grass (*majani mbazi*) from its stalk to carry to its hole! In Angola, according to Anchieta (in Bocage), natives consider the bite of this lizard fatal to man and beast!

Gerrhosaurus flavigularis fitzsimonsi subspec. nov.

1862b. *Gerrhosaurus flavigularis* Peters (not Smith), p. 271.
1905c. Tornier, p. 381.
1905. Neumann, p. 397.
1908. Werner, 1907, p. 1847.
1913c. Nieden (part), p. 80 (Teita only).
1925a. Angel, p. 18.
1933. Flower, p. 791.
1878a. *Gerrhosaurus flavigularis* var. *ocellata* Peters (not Cocteau), p. 203.
1919. *Gerrhosaurus flavigularis flavigularis* Schmidt (not Smith), pp. 519, 601.
1923d. Loveridge, p. 856.
1924b. Loveridge, p. 12.
1929h. Loveridge (part), p. 67 (omit Nairobi, Wambugu, Ottoshoop).
1936j. Loveridge, p. 309.
1937f. Loveridge, pp. 493, 495.
1941. Moreau & Pakenham, p. 108.
1923h. *Gerrhosaurus nigrolineatus* Loveridge (part, not Hallowell), p. 955 (Frere Town sight record only).

Native names. Malombo (Teita); *nakavara* (Pokomo).

Type. Museum of Comparative Zoölogy, No. 41280, an adult ♀ from Mt. Mbololo, Teita, Kenya Colony, collected by Arthur Loveridge, April 19, 1934.

Paratypes. Museum of Comparative Zoölogy, Nos. 13532–3 from Morogoro, Tanganyika Territory (where it occurs with *G. n. nigrolineatus*); No. 17983 from Loita Plains, K. C.; No. 29656 from Mazeras, K. C.; Nos. 29657 and 41275–7 from Voi, K. C.; Nos. 41281–2 from Mt. Mbololo, K. C.; No. 41283 from Ngatana, K. C.; No. 41284 from Golbanti, K. C.

Diagnosis. A rather ill-defined race differing only from typical *flavigularis* from south of the Rovuma River in having the prefrontals usually as broadly in contact as in *G. n nigrolineatus*, specifically

Prefrontals in contact 81% of 33 specimens examined; range: East Africa from Sennar south to the Rovuma River, southern frontier of Tanganyika Territory ..... *f. fitzsimonsi*

Prefrontals separated in 60% of 88 specimens[1]; range: Mozambique south to Natal and western Cape Province .. *f. flavigularis*

This race should not be confused with *G. f. intermedia* Lönnberg (1907) which, from his figure, is a synonym of the long-headed *G. n. nigrolineatus* Hallowell.

Description. Head small, its length being included in the distance from snout to anus 4.75 (young) to 6 (adult) times; head shields smooth, not striated; rostral separated from the frontonasal; prefrontals broadly in contact, or separated[2]; supraoculars 4; supraciliaries 5, rarely 6[3]; tympanic shield narrow, band-like; body cyclotetragonal; dorsals strongly keeled, striated, in 20–22 longitudinal and 59–61 transverse rows; laterals striated and keeled, rarely almost smooth; ventrals in 8 longitudinal and 34–36 transverse rows from pectoral to anal shields; femoral pores 13–15 on each side; fourth toe with 17–19 lamellae below; tail from 2.25 to 2.5 times the length of head and body.

Coloration. Essentially similar to that of the typical form.

Size. Total length of largest known, 494 (144 + 350) mm. from Mazeras; total length of type ♀, 475 (142 + 333) mm., from Mt. Mbololo.

[1] Based on 11 specimens in the Museum of Comparative Zoölogy together with the data of 77 others published by FitzSimons (1935b, Ann. Transvaal Mus. **16**, p. 365) after whom I take pleasure in naming the new form.

[2] In one Mazeras (U.S.N.M. 49148), two Voi (U.M.M.Z. 78850), and two Morogoro (U.M.M.Z. 61142–3) out of a total of 33 examined.

[3] On one side of a Voi lizard (M.C.Z. 41277) only.

Remarks. The above description of this rather ill-defined race is based solely on the type and paratype series of thirty-three lizards.

Breeding. Between April 7 and 19, at Voi and on Mt. Mbololo, numerous females were gravid; three lizards each held 4 eggs which measured approximately 21 x 11 mm., 24 x 11 mm., and 27 x 15 mm., the latter apparently ready for deposition.

Diet. Grasshoppers, locusts, crickets, cockroaches, and the scales of a large *Gerrhosaurus*, presumably part of the slough of the lizard in whose stomach they were found (Loveridge, 1936j).

Habits. Extremely wary and active so that one rarely catches more than a glimpse of the snake-like tail as its elongated owner makes a dash for its burrow at the base of some bush.

Habitat. The semi-arid thornbush country of the coast and uplands.

Localities. **Anglo-Egyptian Sudan:** Hedebat on Blue Nile. **Ethiopia:** Abulcassim camp; Harar. **Kenya Colony:** Bura; Frere Town (seen); Golbanti; Loita Plains; Mazeras; Mt. Mbololo; Ngatana; Sagalla; Sokoki; Teita; Voi. **Tanganyika Territory:** (? Langenburg); Mkuyuni; Mnazi; Morogoro. **Zanzibar ?**

Range. Central Tanganyika Territory north through Kenya and Ethiopia to Sennar in eastern Anglo-Egyptian Sudan.

Gerrhosaurus flavigularis flavigularis Wiegmann

1828. *Gerrhosaurus flavigularis* Wiegmann, Isis von Oken, col. 378: "Africa merid. Krebs."
1830. Wagler, p. 158.
1833. Wagler, pl. xxxiv, fig. 1.
1839. Duméril & Bibron, p. 378.
1844. Smith, A., pl. xxxvii; pl. xlii, figs. 1–4.
1845. Gray, p. 50.
1854. Peters, p. 618.
1855. Peters, p. 47.
1882a. Peters, p. 57.
1887a. Boulenger, p. 122.
1889. Boettger, p. 288. (*flavogularis*)
1891a. Matschie, p. 605.
1892a. Boulenger, p. 174.
1893a. Boettger, p. 95.
1893. Pfeffer, p. 74.
1894a. Günther, 1893, p. 618.
1896a. Bocage, p. 88.
1897e. Boulenger, p. 800.
1898. Johnston, p. 361.
1898. Sclater, p. 105.
1901. Gadow, p. 559.
1902b. Boulenger, p. 17.

1905a. Beddard, p. 61, fig. 17.
1905b. Beddard, p. 256, figs. 33–38.
1907a. Boulenger, p. 8.
1907b. Roux, p. 429.
1908b. Boulenger, p. 226.
1910b. Boulenger, p. 480.
1910a. Hewitt, pp. 56. 57, 62, 66, 67.
1910c. Hewitt, pp. 103, 105.
1910a. Werner, p. 341.
1911d. Sternfeld (part), p. 35 (Kokong only).
1913. Hewitt & Power, p. 157.
1913a. Werner, in Brehm, p. 191, fig. –
1920b. Angel, p. 616.
1920. Hewitt, p. 91.
1920a. Loveridge (part), p. 150.
1928. Cott, p. 953.
1928a. Essex, 1927, p. 933.
1929. Rose, p. 120, figs. 78–79.
1931. Power, pp. 42, 48.
1935. Power, p. 333.
1935. Lawrence, p. 44.
1937a. Flower, p. 27.
1937e. Hewitt, p. 43, pls. xi, xxvii.
1940. Malan, p. 192, figs.
1833. *Gerrhosaurus Ocellatus* Cocteau, Mag. Zool. Guer., cl. iii, pl. iv, pl. **vi**, fig. 1: Cape of Good Hope.
1836. *Pleurotuchus Desjardinii* A. Smith, Mag. Zool. Bot. (Jardine), **1**, p. 143: Southeast coast of South Africa.
1836. *Pleurotuchus chrysobronchus* A. Smith, Mag. Zool. Bot. (Jardine), **1**, p. 144: Near sources of Cowie River about Grahamstown and Blue Kranz, South Africa.
1844. *Gerrhosaurus bibroni* A. Smith, Illus. Zool. S. Africa, Rept., pl. xxxviii, fig. 1, pl. xlii, figs. 9–12: Near sources of Caledon River, Quathlamba Mountains, Orange Free State.
1845. Gray, p. 50.
1851. Duméril, A., p. 141.
1883b. *Gerrhosaurus flavigularis* var. *quadrilineata* Boettger, Ber. Offenbacher Ver. Natur., Nos. 22–23, p. 156: Smithfield, Orange Free State, Union of South Africa.
1922a. Mertens, p. 174.
1896c. *Gerrhosaurus nigrolineatus* Bocage (not Hallowell), p. 118.
1898. Werner, 1896–7, p. 142.
1919. *Gerrhosaurus flavigularis flavigularis* Schmidt (part), p. 519.
1934a. Cott, p. 164.
1934. Pitman, p. 305.
1935b. FitzSimons, p. 365.
1937a. FitzSimons, p. 272.
1939b. FitzSimons, p. 34.

Native name. *Zumondua* (Sena: Cott).

Description. Head small, its length being included in the distance from snout to anus 4.8 (young) to 6.6[1] (adult) times; head shields smooth or faintly striated; rostral separated from the frontonasal; prefrontals separated or sometimes[2] in contact; supraoculars 4; supraciliaries 5, rarely 6[3]; tympanic shield narrow, band-like; body cyclotetragonal; dorsals feebly or strongly keeled, striated, in 20–24[4] longitudinal and 55[5]–67 transverse rows; laterals keeled and striated in young, smooth in adults, in 8[6] longitudinal and 32–38 transverse rows from pectoral to anal shields; femoral pores 10–16 on each side; fourth toe with 17–21 lamellae below; tail 1.5 (young) to 2.1 (adult) times the length of head and body.

Coloration. Above, head olive brown or yellowish, uniform or mottled with darker (in young sides of head bright yellow with two vertical black bars in temporal region); a dark-edged, white, greenish, or pale lemon yellow (in young bright yellow), dorsolateral line from supraocular region to tail anteriorly; vertebral region olive to chocolate brown, uniform, or with a pair of fine, dark-edged, pale lines, more usually broken up into a series of black-edged, pale dashes or squarish spots with white central shaft; flanks light olive to sandy brown, uniform or flecked with white, yellow, dull red (adults), dark brown, or black (in young forming black-bordered, greenish, or bright yellow vertical bars); limbs uniform or with black-edged, pale (in young greenish or bright yellow) spots. Below, throat white or yellow, rest of undersurface uniform creamy white or yellowish.

The contrasting coloration of adult and young in Mozambique are described by Cott (1934a.). Drury, in Hewitt (1937e) records a lizard from Bushman River as having its snout tinged with red, upper lips scarlet, throat scarlet superimposed on yellow.

Size. Total length of ♀, 378 (121 + 257) mm. from Vumba Mtn. (M.C.Z. 44423), but surpassed in length of head and body by another ♀ of 130 mm. from Umvoti River (M.C.Z. 44063).

Remarks. Wagler (1828–33) gives supraciliaries 4, supraorbitals 5, an obvious switch in designation of these scales as at present under-

[1] 8.1 times, *fide* FitzSimons (1935b).

[2] FitzSimons (1935b) with 77 specimens, found it widely separated in 20, separated by an azygous shield in 2, narrowly separated in 19, narrowly in contact in 8, in fair contact in 28.

[3] On one side of a Pretoria specimen (M.C.Z. 14237) and one side of a Port Alfred lizard (U.M.M.Z. 61187).

[4] 20–28 in Hewitt (1910c) is presumably a misprint.

[5] 55 *fide* Boulenger (1887a), my lowest is 58 (U.M.M.Z. 61487).

[6] 10 recorded by Sir A. Smith (1844) is undoubtedly a slip.

stood. Recently the type of *bibroni* has been reëxamined by FitzSimons (1937a).

Anatomy. Various anatomical features, particularly the brain, have been dealt with by Beddard (1905a, 1905b), and the so-called branchial arch by Hewitt (1920).

Breeding. On February 15, at Caia, a captive ♀ laid 6 eggs measuring 22.5 x 14 mm. (Cott), such an egg, about 19 x 13 mm., has been figured by Hewitt (1937e, pl. xxxvii, fig. 1).

Longevity. 11 years, 3 months, 21 days (Flower).

Diet. A mantid, five grasshoppers, and three ants, in four lizards examined by Cott (1934a); crickets, beetles and millipedes (Essex); in captivity, besides insects, scraps of meat and such unexpected items as pieces of banana and watermelon (Rose).

Parasites. Mites (*Pterygosoma bicolor* and *P. hystrix*) were found by Lawrence.

Defence. Struggles violently and bites freely, while if the tail is seized it is immediately discarded.

Temperament. Essex's (1928) charge of intractability is refuted by Rose (1929) who states that, though attempting to bite when first captured, if gently handled these yellow-throated lizards become exceptionally docile and tractable; some which were kept on a rockery docilely submitted to recapture and would lie placidly on one's hand without sign of fear or attempt at escape. They soon learned to take food from the hand.

Hibernation. They hibernate at Gleniffer according to Ranger, in Hewitt (1937e).

Habitat. This shy lizard dwells in a hole or burrow usually excavated beneath a bush, which may be in a wide variety of situations from the sea shore and sandy bush country of the coast to grassy flats and rocky ravines on mountain slopes. Smith's (1836) original statement regarding damp situations seems to have been purely fortuitous. In the Kalahari it is to be found on the rocky outcrops and kopjes of the eastern fringe, according to FitzSimons, who also states that it does not occur in the southwest part of Cape Province (1935b, p. 365) which is not borne out by Hewitt (1910a, p. 62) or Rose (1929, p. 120) for the latter says that it occurs, though rarely, on the Peninsula.

Localities. **Cape Province:** Bath's Hill near Grahamstown; Blaauwkrantz; Cape Town; Cowie River sources; East London; Gleniffer; Grahamstown; Hermanus; Kalk Bay; Knysna; near Kowie River, Pondoland; Port Alfred; Port Elizabeth; Port St. Johns; Robertson; Rondebosch; Schoenmaker's Kop, Port Elizabeth; Transkei. **Natal:**

Durban; Lobatsi; Lower Illovo River; Pietermaritzburg; Umvoti River. **Basutoland. Orange Free State:** Caledon River sources in Drakensberg (=Quathalamba) Mts.; Smithfield. **Zululand:** Mseleni. **Transvaal:** Botsabelo near Middleburg; Johannesburg; Linokana; Mphome, Zoutpansberg district; Pretoria. **Bechuanaland:** Gabani; Gaberones; Kalahari; Kokong to Kong; Molepole; Serowe; Shoshong; Taungs. **Southern Rhodesia:** Changadzi River; Mazoe; Salisbury district; Vumba Mtn. **Northern Rhodesia:** Luangwa River. **Nyasaland:** Fort Hill, Masuku district; Nkata Bay to Ruarwe; Nyika Plateau; Shire Highlands. **Mozambique:** Amatongas; Caia; Charre; Lumbo; Quilimane; Tete.

Range. Western Cape Province east to Natal, north to Mozambique, Nyasaland, and Northern Rhodesia.

Genus Cordylosaurus

1845. *Pleurostriehus* Gray (part), Cat. Lizards Brit. Mus., p. 51 (type: *Scincus sepiformis* Schneider).

1865a. *Cordylosaurus* Gray, Proc. Zool. Soc. London, p. 641 (type: *trivirgatus* Gray = *trivittatus* Peters).

Tongue nearly entirely covered with imbricate scale-like papillae; nostril pierced between 2 nasals and first labial; no prefrontals; frontoparietals present (in young) or absent (in adults); lower eyelid with a transparent disk; dorsal and ventral scales forming straight longitudinal and transverse series; a strong lateral fold; limbs well developed; subdigital scales keeled; femoral pores present.

Range. Southwest Africa (Western Cape Province north to Angola).

Cordylosaurus subtessellatus (Smith)

1844. *Gerrhosaurus subtessellatus* A. Smith, Illus. Zool. S. Africa, Rept., pl. xli, fig. 2; Great Namaqualand, South West Africa.

1844. *Gerrhosaurus tessellatus* A. Smith, pl. xlii, figs. 17–20 (error for *subtessellatus*).

1845. *Pleurostriehus subtessellatus* Gray, p. 51.

1862a. *Gerrhosaurus trivittatus* Peters, Monatsb. Akad. Wiss. Berlin, p. 18: Neu Barmen, South West Africa.

1869b. Peters, p. 659.

1865a. *Cordylosaurus subtessellatus* Gray, p. 641.

1887a. Boulenger, p. 126.

1898. Sclater, p. 105.

1910b. Boulenger, p. 482.

1910c. Hewitt, pp. 103, 105, 106.

1911d. Sternfeld, p. 37 (mispelled)
1935. Lawrence, p. 44.
1937a. FitzSimons, p. 269.
1865a. *Cordylosaurus trivirgatus* Gray, Proc. Zool. Soc. London. p. 641, pl. xxxviii, fig. 2: Damaraland, South West Africa.
1867a. Bocage, p. 222.
1865b. *Cordylosaurus trivittatus* Gray, p. 148.
1887a. Boulenger, p. 126.
1888b. Fischer, p. 12.
1895a. Bocage, p. 37.
1898. Sclater, p. 105.
1910a. Werner, p. 341.
1910b. Boulenger, p. 482.
1910a. Hewitt, p. 62.
1910c. Hewitt, pp. 103, 105, 106.
1911. Lampe, p. 173.
1911b. Sternfeld, p. 406.
1911d. Sternfeld, p. 36, fig. 45.
1914b. Methuen & Hewitt, p. 140.
1915c. Werner, p. 347.
1935. Lawrence, p. 44.
1936c. Parker, p. 132.
1937b. Mertens, p. 8.
1937b. Monard, p. 77.
1938. FitzSimons, p. 199.
1910a. *Cordylosaurus tessellata* Hewitt, p. 62.
1932. *Cordylosaurus trivittatus australis* Hewitt, Ann. Natal Mus., **3**, p. 114, pl. vi, fig. 5: Between Garies and Kamiesberg, Namaqualand, Cape Province.
1935. Lawrence, p. 44.

Native name. Humbohumbo (at Dombe: Anchieta).

Description. Head and body depressed. Rostral separated from the frontonasal; no prefrontals; supraoculars 4; supraciliaries 4; frontoparietals, interparietal, and parietal separate and distinct in young, fused into a single shield in adults; tympanic shield narrower or broader than the posterior upper temporal; dorsals distinctly keeled (or nearly smooth, see *Remarks* below), tri- or quinquecarinate or those in lumbar region with a median keel, in 15 longitudinal and 52–55 transverse rows; ventrals in 8 longitudinal rows; femoral pores 7–10 on each side, the distal ones less developed in females; tail about 2 to 2.7 times the length of head and body.

Coloration. Above, dark brown or black; a pale olive, pale buff, or yellowish, dorsolateral line, never more than two scales in width

on body, commencing on head becomes pinkish buff or pale greenish blue posteriorly changing to bluish green or bright blue on tail; limbs tinged with pink; feet, or at least the digits, reddish. Below, chin pinkish buff; chest and belly whitish; limbs reddish.

The above description refers to "*trivittatus*", that for *subtessellatus* was described in great detail by Smith in the letterpress accompanying pl. xli. Boulenger (1887a), however, has condensed it as follows: Above, middle of back yellow brown, dorsolateral region chequered white and blackish; sides dark brown. Below, brownish.

Size. Total length of type, 151 (50 + 101) mm. (Boulenger). The largest "*trivittatus*" recorded was 121 (44 + 77) mm. Parker's (1936c) statement that his largest ♀ measures "only 143 mm. from snout to vent" may be assumed to be a misprint for 43 mm., or for total length.

Remarks. For a century *subtesselatus* has been known only from the description and two cotypes, of which one, preserved in the British Museum, has been checked with the original description by FitzSimons (1937a). The dorsals were stated to be "quite smooth" and "destitute of even the rudiments of a keel" (Smith) and by Boulenger as "nearly smooth." As this cotype is so much larger than any other known specimen, it seemed reasonable to suppose that its smooth condition might be attributable to age. A second specimen, without locality, is in the South African Museum, one wonders if it can be the missing cotype. It was seen by Methuen and Hewitt (1914b) at which time they thought it was but a color variant of *trivittatus;* they saw, but failed to catch, a lizard which seemed to them to be a *subtessellatus.* As Mr. V. FitzSimons is probably the only living herpetologist who has examined both the known specimens, I appealed to him for an opinion as I doubted the distinctness of the two forms which are generally separated as follows:

Dorsal shields nearly smooth . . . . . *subtessellatus*
Dorsal shields keeled, even though feebly . . . . . *trivittatus*

He replied (1942): "I am inclined to regard *Cordylosaurus subtessellatus* and *trivittatus* as synonymous; the cotype in S.A.M. is in such bad condition that it cannot be differentiated from *trivittatus.*"

Hewitt (1932) described *australis* on the basis of two specimens in which the interparietal and parietal were fused and the pale dorsolateral lines narrower, *i.e.* less than two scales broad, not encroaching on a third scale, than in the only South West African example of *trivittatus* which he had for comparison. Parker (1936c) with twelve S. W. African specimens found them to cover all the variations listed by Hewitt as distinguishing *australis* with the exception of the keeling

of the scales, which, in *australis*, were said to lack the strong central keel of *trivittatus* though well keeled in the lumbar region. Parker points out that the condition of the parietals is an age character, a view corroborated by FitzSimons (1938) who found the tympanic shield in his series much narrower than the posterior upper temporal, whereas Parker had found it always broader.

Sexual dimorphism. Hewitt (1932) states that the dorsal scales from head to shoulders are multicarinate in a ♂ and smooth in a ♀ which were taken between Garies and Kamiesberg.

Habits. This lizard is very active, the lateral undulations which it employs when moving fast remind one of those of a snake, according to Jordan (in Parker, 1936c); the tail is readily discarded.

Habitat. Both cotypes were captured by Sir A. Smith personally, being taken among short grass in the vicinity of a low rocky knoll. FitzSimons found them beneath stones on a sandy, open hillside, and one in a hole at the foot of a mopane tree.

Localities. **Cape Province:** Calvinia Division; Clanwilliam Division; De Aar; Garies to Kamiesberg (*australis*); Kakamas; Klaver; Little Namaqualand; Steinkop. **South West Africa**: Aus to Bethanien; Churutabis; Damaraland; Gobabis; Great Namaqualand (*subtesselatus*); Hereroland; Hoffnung; Kalkveld; Karibib; Kraikluft; Great Karas Mtns.; Kuibis; Narudas Süd; Neu Barmen; Okahandja; Okaukuejo to Outgo; Rietmond; Tsumeb (Usumeb); Voigtsgrund; Windhuk. **Angola:** Benguela; Catumbela; Dombe; Rio Coroca.

Range. Cape Province north through South West Africa to Angola.

Folklore. Methuen (1914b) relates how he was offered a sovereign for one of these lizards by a Bastaard Hottentot, who, though regarding it as poisonous (to eat?), considered it a valuable antidote for snakebite.

Genus Tetradactylus

1802d. *Chalcides* Daudin (part, not of Laurenti, 1768), Hist. Nat. Rept., **4**, p. 359.

1820. *Tetradactylus* Merrem (not Duméril & Bibron, M. S. Paris Mus.) Vers. Syst. Amph., pp. 13, 75 (type: *tetradactylus* Daudin).

1825. *Cicigna* Gray, Ann. Philos. (2), **10**, p. 201 (type: *Scincus sepiformis* Schneider).

1826. *Saurophis* Fitzinger, Neue Classif. Rept., p. 20 (type: *Lacerta seps* Linnaeus).

1838. *Caita* Gray, Ann. Nat. Hist., **1**, p. 389 (type: *africana* Gray).

For further synonymy see Boulenger, 1887a, Cat. Lizards Brit. Mus., **3**, p. 124.

Tongue covered with oblique plicae converging anteriorly towards the median line; nostril pierced between 2 (rarely 3) nasals and first labial, or latter rarely excluded; no prefrontals; frontoparietals present; lower eyelid scaly; dorsal and ventral scales forming straight longitudinal and transverse series; a strong lateral fold; fore limbs present or absent; digits, if present, smooth inferiorly; femoral pores present or absent.

The members of this genus present an interesting series of stages between the four-footed *Gerrhosaurus* and the serpentiform *Paratetradactylus*.

Range. Union of South Africa; Angola; Belgian Congo.

SYNOPSIS OF VARIATION IN THE GENERA TETRADACTYLUS & PARATETRADACTYLUS

Species	Digits on Fore limb	Digits on Hind limb	Dorsal rows longitudinally	Dorsal rows transversely	Ventral rows longitudinally	Femoral pores	Max. length of head and body	Max. length of tail	Range
s. seps	5	5	13	57–61	8	8–12	59	132	W. Cape Prov.
s. laevicauda	5	5	13	62	8	7	63	122	E. Cape Prov.
t. tetradactylus	4	4	14	61–64	6	4–5	70	214	W. Cape Prov.
t. bilineatus	4	4	14	63	6	4–5	63	–	E. Cape Prov.
eastwoodae	3	2	12	67	6	3	64	126	Transvaal
breyeri	2	1	12	70	8!	2	56	106	Transvaal
africanus	1	1	14	69–70[1]	6	2–3	72	250	Natal: Zulul.
f. fitzsimonsi	0	1	14	69–70	6	2–3	78	237	Cape Provin.
f. boulengeri	0	1	12	64	6	0	66	200	Congo Belge
(*lundensis*)	0	1	12	–	6	0	53	195	Angola
P. ellenbergeri	0	1	14	65	6	0	64	216	N. Rhodesia

[1] 60–62 *fide* Boulenger, but doubted by Hewitt.

Key to the Species

1. Ventrals in 8[1] rows across belly; dorsals in 13 rows across back; limbs short but pentadactyle 2
   Ventrals in 6[1] rows across belly; dorsals in 12 or 14 rows across back; limbs, if present, not pentadactyle 3

2. Head shields striated or slightly rugose; caudals keeled; femoral pores 8–12; range: Western Cape Province . . . . . *s. seps* (p. 526)
   Head shields smooth; caudals mostly smooth; femoral pores 7; range: Eastern Cape Province and Natal . . . . . *s. laevicauda* (p. 527)

3. Limbs tetradactyle 4
   Limbs, if present, with three toes or less 5

4. Nostril bordered by 2 scales and a labial; third finger subequal to, or but slightly longer than, the second; range: Western Cape Province . . . . . *t. tetradactylus* (p. 528)
   Nostril bordered by 3 scales but no labial; third finger considerably longer than second; range: Eastern Cape Province . . . . . *t. bilineatus*[2] (p. 529)

5. Hind limb with 2 clawed digits, fore limb with 3; range: Transvaal . . . . . *eastwoodae* (p. 530)
   Hind limb undivided, fore limb, if present, with not more than 2 clawed digits 6

6. Fore limb present 7
   Fore limb absent 8

7. Fore limb with 2 clawed digits; ventrals *said to be* in 8 rows across belly; range: Transvaal . . . . . *breyeri* (p. 530)
   Fore limb undivided; range Natal and Zululand . . . . . *africanus* (p. 531)

8. Preanal pores 2–3; dorsals in 14 longitudinal and 69–70 transverse rows from parietal to base of tail; range: Cape Province . . . . . *f. fitzsimonsi* (p. 532)
   Preanal pores 0–0; dorsals in 12 longitudinal and 64 transverse rows from parietals to base of tail; range: Eastern Angola and southern Belgian Congo . . . . . *f. boulengeri* (p. 533)

[1] Said to be 8 in *breyeri* also.
[2] A somewhat doubtful race.

Tetradactylus seps seps (Linnaeus)

1758. *Lacerta Seps* Linnaeus, Syst. Nat., ed. 10, **1**, p. 204: "In Meridionalibus."
1760. Linnaeus, p. 363.
1801. *Sincus (sic) sepiformis* Schneider, Hist. Amphib., **2**, pp. 171, 191: No locality.
1820. *Tachydromus seps* Merrem, p. 69.
1825. *Cicigna sepiformis* Gray, p. 201.
1839. *Gerrhosaurus sepiformis* Duméril & Bibron, p. 384.
1844. A Smith, pl. xli, fig. 1, pl. xlii, figs. 13–16.
1851. Gravenhorst, p. 301, pl. xxvii, figs. 1–7.
1845. *Pleurostrichus sepiformis* Gray, p. 51.
1887a. *Tetradactylus seps* Boulenger, p. 124.
1887b. Boettger, p. 149.
1890b. Müller, p. 701.
1898. Werner (1896–7), p. 142.
1898. Sclater, p. 105.
1901. Gadow, p. 559.
1907b. Roux, p. 429.
1910b. Boulenger, p. 481.
1910a. Hewitt, p. 62.
1910c. Hewitt, pp. 103, 105.
1913. Hewitt & Power, p. 157.
1926b. Rose, p. 493.
1927b. Hewitt, p. 454.
1928a. Essex, 1927, p. 933.
1929. Rose, p. 124, fig. 81.
1935. Lawrence, p. 44.

Description. Habit elongate; limbs pentadactyle, short, the length of the hind limb equals or exceeds the distance from snout to fore limb; tail about 1.5 to 2.2 times the length of head and body.

Head shields striated or slightly rugose; dorsals strongly striated, the posterior, as also the upper caudals, with a strong median keel, in 13 longitudinal and 57–61 transverse rows; ventrals in 8 longitudinal rows; femoral pores 8–12 on each side.

Coloration. Above, olive, olive bronze, or reddish brown; upper lip with small, yellow, dark-edged spots; edges of the scales darker; sides usually darker. Below, gray or iridescent olive.

Size. Total length of largest, 191 (59 + 132) mm. (Boulenger).

Habits. A common species on grass-grown mountain slopes where, though in slow movements progressing by use of its limbs alone, its slender form plays a major part in the rapid undulations which assist its departure. In such serpentine movements the feet do not appear

to be employed (Rose). Retires beneath stones (Essex). Occurs up to 6000 feet.

Localities. **Cape Province,** western: Cape Flats; Cape Peninsula; Cape Town; Kalk Bay; Knysna; Paarl Division; Robben Island; Somerset Strand; Table Mountain.

Range. Western Cape Province.

Tetradactylus seps laevicauda Hewitt

1915. *Tetradactylus laevicauda* Hewitt, Ann. Transvaal Mus., **5**, p. 101: Tabamhlope, Natal.
1927b. Hewitt, p. 454.
1928a. Essex, 1927, p. 933.
1935. Lawrence, p. 44.
1937e. Hewitt, p. 44, pl. xiv.

Description. Habit elongate; limbs pentadactyle, short, the length of the hind limb exceeds the distance from snout to fore limb; tail about 2 times the length of head and body.

Head shields quite smooth; dorsals fairly strongly striated, the posterior, as also the upper caudals, without a median keel, in 13 longitudinal and 62 transverse rows; ventrals in 8 longitudinal rows; femoral pores 7 on each side.

Coloration. Above, olive; upper lip and sides of neck with small pale spots; a pale dorsolateral line, commencing at nostril, broadens at midbody, and terminates on tail anteriorly; sides and limbs brownish black, some black and pale spots on the former anteriorly. Below, pale, olive green to bluish- or grayish-green; tail pale olive brown.

Size. Total length of type, 185 + (63 + 122 +) mm., tail incomplete.

Remarks. Essex appears to be mistaken in supposing that the tail length of *laevicauda* is proportionately longer than that of typical *seps* with tail intact. The above description is taken almost entirely from that of the original holotype (T. M. 2524) which may be consulted for minor details.

Localities. **Natal:** Tabamhlope. **Cape Province,** eastern: Drakensberg; Hogsback, Amatola Mtns.; Katberg.

Range. Eastern Cape Province to Natal.

Tetradactylus tetradactylus tetradactylus (Daudin)

1802d. *Chalcides tetradactylus* Daudin, Hist. Nat. Rept., **4**, p. 362: No locality.
1803. Lézar tétradactyle Lacépède, Ann. Mus. Nat. Hist. Nat., **2**, p. 357, pl. lix, fig. 2: says type donated by Dutch Republic.
1820 *Tetradactylus chalcidicus* Merrem, Vers. Syst. Amphib., pp. 13 and 75: No locality.
1822. *Seps tetradactylus* Schinz, p. 90.
1826. *Saurophis seps* Fitzinger (not Linné), p. 50.
1849. Smith, A., p. 9.
1829–1844. *Chalcis tetradactyla* Guérin, pl. xvi, fig. 2.
1830. *Saurophis tetradactylus* Wagler, p. 159.
1845. Gray, p. 51.
1839. *Saurophis Lacepedii* Duméril & Bibron, Erpét. Gén., 5, p. 389: South Africa.
1851. Gravenhorst, p. 304, pl. xxvii.
1887a. *Tetradactylus tetradactylus* Boulenger, p. 125.
1898. Sclater, p. 105.
1910b. Boulenger, p. 481.
1910a. Hewitt, p. 62.
1910c. Hewitt, pp. 103, 106.
1916. Andersson, p. 39.
1926b. Rose, p. 493.
1927b. Hewitt, p. 454.
1928a. Essex, 1927, p. 933.
1929. Rose, p. 125.
1935. Lawrence, p. 44.
1896c. *Caita tetradactyla* Bocage, p. 118 (see remarks under localities).

Description. Habit serpentiform; limbs tetradactyle, very short, the hind limb extending back to the sixth or seventh[1] or tenth[2] row of caudals; tail about 3.3 times the length of head and body.

Head shields smooth; dorsals strongly striated, keeled, in 14 longitudinal and 61–62 transverse rows; ventrals keeled, in 6 longitudinal rows; femoral pores 4–5 on each side.

Coloration. Above, olive brown; head spotted with dark brown; temple and sides of neck usually with dark brown vertical bars; a dark brown dorsolateral line separated from its fellow by 2 scales, the inner halves of the two median dorsal scales being without pigment. Below, pale olive.

[1] *fide* Hewitt (1926a).
[2] *fide* Loveridge, see Remarks below.

Size. Total length of largest, 285 (65 + 220) mm., but exceeded in body length by one (M. C. Z. 45481) 284 (70 + 214) mm.

Remarks. This fine specimen received from Stellenbosch University, and presumably taken in that vicinity, agrees with the typical form in points (a) and (c) of Hewitt (1926a) but with his race *bilineatus* in points (b) and (d), i.e., the frontal is twice as broad as long, the fore limb extends back to 8½ ventral rows, the hind limb extends back along 10 caudal scales. It would rather appear as if the race has been founded on somewhat slender grounds.

Enemies. In gullet of Secretary Vulture (Andersson).

Habits. Exceedingly quick and difficult to catch (Rose). Since the serpentiform gliding movements are so rapid, it is impossible to say whether the tiny legs play any part, but at rest the lizard sometimes raises itself by means of its limbs (Essex).

Habitat. Grassy mountain slopes.

Localities. **Cape Province,** western: Fransche Kraal, Gans Bay; Hout Bay; Lions Head; Namaqualand (?); Robertson; Worcester Division.

Bocage's (1896c) recording of *Scelotes bipes* and this species from Linokana, Transvaal, is almost certainly erroneous, as pointed out by Hewitt (1910c, p. 106) for these species are otherwise known only from southwestern Cape Province. The identification rather than the locality seems to be at fault, however; we can idly speculate that he had a juvenile *Gerrhosaurus f. flavigularis*, which is abundant at Linokana according to Power, or possibly that he had either of the Transvaal species—*eastwoodi* or *breyeri*—neither of which then were known. Neither has 4 digits on the anterior limb, however, being 3 and 2 respectively.

Range. Western Cape Province.

Tetradactylus tetradactylus bilineatus Hewitt

1926a. *Tetradactylus bilineatus* Hewitt, Ann. S. Afr. Mus., **20**, p. 417: Burghersdorp district, Cape Province.
1927b. Hewitt, p. 454.
1935. Lawrence, p. 44.
1937e. Hewitt, p. 43.

Description. Habit serpentiform; limbs tetradactyle, very short, the fore limb extending back over 9 ventral rows, the hind limb extending back to the ninth row of caudals; tail injured in holotype.

Nostril bordered only by 3 nasals of which the lowest is elongated, excluding the first labial; frontal about twice as long as broad; dorsals

strongly striated, keeled, in 14 longitudinal and 63 transverse rows; ventrals keeled, in 6 longitudinal rows; femoral pores 4–5 on each side.

Coloration. Above, olive brown; head spotted with dark brown; a dark brown dorsolateral line separated from its fellow by 3 scales, i.e. the two median dorsal scales and inner half of the third being without pigment. Below, pale olive.

Size. Total length of holotype from snout to anus 53 mm., tail injured.

Remarks. See those under the typical form.

Localities. Known only from the type in Albany Museum.

Range. Eastern Cape Province.

Tetradactylus eastwoodae Methuen & Hewitt

1913c. *Tetradactylus eastwoodae* Methuen & Hewitt, Trans. Roy. Soc. S. Africa, **3**, p. 109: Woodbush, Zoutpansberg District, Transvaal.
1927b. Hewitt, p. 454.
1935. Lawrence, p. 44.

Description. Habit serpentiform; limbs very short, the anterior with 3 clawed digits, median longest, the posterior with two clawed digits, inner minute; reproduced tail about 2 times the length of head and body.

Dorsals strongly striated, keeled, in 12 longitudinal and 67 transverse rows; ventrals in 6 longitudinal rows; femoral pores 3 on each side.

Coloration. Above, head spotted with black, otherwise uniform brown. Below, pale grayish brown.

Size. Total length of holotype, 190 (64 + 126) mm., but tail partly reproduced; fore limb 5 mm.; hind limb 6.5 mm.

Remarks. The authors state that the head shields resemble those of *T. africanus*, but that the interparietal is more elongated, separating the frontoparietals and forming a suture with the frontal.

Localities. Known only from the holotype (Tvl. Mus. 1496).

Range. Transvaal.

Tetradactylus breyeri Roux

1907b. *Tetradactylus breyeri* Roux, Zool. Jahrb. Syst., **25**, p. 430, pl. xiv, fig. 6: Transvaal.
1910b. Boulenger, p. 481.
1910a. Hewitt, p. 62.
1910c. Hewitt, pp. 103, 105.
1927b. Hewitt, p. 454.
1935. Lawrence, p. 44.

Description. Habit serpentiform; limbs short, the anterior with 2 clawed digits of which the second is only slightly developed, the posterior is undivided, without claw; tail about 3 times the length of head and body.

Nostril bordered only by 2 nasals, the first labial being excluded; dorsals and caudals striated, keeled, in 12 longitudinal and 70 transverse rows; ventrals in 8 longitudinal rows; femoral pores 2 on each side.

Coloration. Above, brown, sides of neck and body anteriorly with black vertical bars; a dark brown line from eye to insertion of fore limb, and a brown dorsolateral line from above fore limb extending on to tail. Below, olive.

Size. Total length of holotype, 222 (56 + 166) mm.; forelimb 4.5 mm.; hind limb 4 mm.

Remarks. For further details consult original description.

Localities. **Natal:** Umvoti (S.A.Mus.); Weenen County (Tvl. Mus.); **Transvaal.**

Range. Natal north to Transvaal.

Tetradactylus africanus (Gray)

1838. *Caita africana* Gray, Ann. Nat. Hist., **1**, p. 389: Cape of Good Hope, i.e. South Africa.
1849. Smith, A., pl. lxxvi, figs. 1–1c.
1887a. *Tetradactylus africanus* Boulenger, p. 125, pl. iv, fig. 3.
1898. Sclater, p. 105.
1898. Werner, 1896–7, p. 142.
1901. Gadow, p. 559.
1908b. Boulenger, p. 226.
1910b. Boulenger, p. 481.
1910a. Hewitt, p. 62.
1910c. Hewitt, pp. 103, 105, 106.
1915. Hewitt, p. 102.
1927b. Hewitt, p. 454.
1928a. Essex, 1927, p. 912, figs. 35–38.
1935. Lawrence, p. 44.

Description. Habit serpentiform; limbs minute, undivided; tail about 3.4 times the length of head and body.

Dorsals strongly striated, keeled, in 14 longitudinal and 60–62[1] or

[1] *fide* Boulenger (1887a), but considered a misprint by Hewitt (1915) and FitzSimons (1942, in letter), the latter finding 70–72 in the three examples in the Transvaal Museum.

69–72 transverse rows; ventrals in 6 longitudinal rows; femoral pores 2–3 on each side.

Coloration. Above, olive or reddish brown; upper lip pale lemon yellow; temple and side of neck with dark brown vertical bars; back with dark brown longitudinal lines; side of body and lateral fold anteriorly lemon yellow. Below, pale olive.

Size. Total length of a cotype, 322 (72 + 250) mm.

Anatomy. Essex figures the pelvic girdle and bones of fore and hind limbs.

Remarks. Hewitt (1915) states that an *africanus* from Witzieshoek, near Harrismith, has 69–70 dorsals in transverse series like *fitzsimonsi*, but possesses a broader interparietal than that species and lacks dark spots upon its head.

Habitat. Grassland.

Localities. **Natal:** Durban; Harrison, (T. Mus.); Umvoti; Witzieshoek. **Zululand:** Eshowe (T. Mus.); Melmoth.

Boulenger's (1910b) records of Little Namaqualand and Bocage's (1895a) Angola are omitted pending confirmation by other workers.

Range. Natal north to Zululand.

Tetradactylus fitzsimonsi fitzsimonsi Hewitt

1915. *Tetradactylus fitzsimonsi* Hewitt, Ann. Transvaal Mus., **5**, p. 101: Schoemachers Kop, near Port Elizabeth, Cape Province.
1927b. Hewitt, p. 454.
1935. Lawrence, p. 44.
1937e. *Tetradactylus africanus fitzsimonsi* Hewitt, p. 44.

Description. Habit serpentiform; fore limbs absent; hind limbs minute, undivided, terminating in a claw, length of hind limb slightly less than half the distance from snout to tympanum; reproduced tail about 3.3 times the length of head and body.

Head shields smooth; dorsals strongly striated, keeled, especially the two median rows, in 14 longitudinal and 69–70 transverse rows; ventrals in 6 longitudinal rows; femoral pores 2–3 on each side.

Coloration. Above, olive, head and neck spotted with darker; temple and side of neck with dark vertical bars. Below, pale olive to grayish brown.

Size. Total length of type, 175.5 + (78.5 + 97 +) mm., a second specimen 309 (72 + 237) mm.; hind limb of type 5 mm.

Localities. **Cape Province:** Schoemacher's Kop, near Port Elizabeth.

Hewitt also records a paratype with doubts from Kroonstad (whether that in the Orange Free State or the Transvaal not stated); later he (1937e) evidently rejects this entirely for he states that the species is known only from Port Elizabeth. FitzSimons (1942, in letter) supports Hewitt's view.

Range. Cape Province.

Tetradactylus fitzsimonsi boulengeri Witte

?1895a. *Caita africana* Bocage (? not Gray), p. 37.
?1937b. *Tetradactylus africanus* Monard (? not Gray), p. 77.
1933f. *Tetradactylus Boulengeri* de Witte, Rev. Zool. Bot. Afr., **23**, p. 186: Kansenia, Pande Valley, Katanga, Belgian Congo.
1933m. Witte, p. 75.
1937b. *Tetradactylus lundensis* Monard, Arquiv. Mus. Bocage, **8**, p. 79: Lunda, Upper Tyiumbwe River, eastern Angola.

Description. Habit serpentiform; fore limbs absent; hind limbs minute, undivided, terminating in a claw, length of hind limb slightly less than a quarter the distance from snout to tympanum; tail from 3 (*boulengeri*) to 3.7 (*lundensis*) times the length of head and body.

Head shields strongly striated, keeled, especially the two median rows, on most of the body, the striae most pronounced anteriorly diminishing posteriorly till on the tail only faint traces of them remain, in 12 longitudinal and 64 transverse rows; ventrals in 6 longitudinal rows; femoral pores absent.

Coloration. Above, brownish olive; head shields edged and spotted with black; temples and side anteriorly with black vertical bars; the two median vertebral rows of keels brown; a bluish lateral band commences on snout but does not extend beyond anterior third of body, scales on this band are edged and spotted with black. Below, bluish, or whitish tinged with yellow on the throat.

Size. Total length of holotype of *boulengeri*, 266 (66 + 200) mm., of type of *lundensis*, 248 (53 + 195) mm., length of hind limb 2 mm. for both specimens.

Remarks. Witte states that *boulengeri* differs from *fitzsimonsi* in having more strongly striated head shields, fewer dorsals, and no femoral pores. Later he compared it with one of the type series of *lundensis* and remarked (in Monard) that the shape and proportion of the interparietal, which is triangular and broader than long in *boulengeri*, rhomboidal and half as broad as long in *lundensis*, together with the striations of the head shields, parallel in *lundensis*, ramified in *boulengeri*, were the only differences which he could detect.

No one has examined these lizards to ascertain whether these differences are not attributable to sex or age, and though I have not had the opportunity of seeing the types, these differences scarcely seem of specific importance, with more material *lundensis* may yet be accorded subspecific rank.

Localities. **Angola,** eastern: Lunda. **Belgian Congo:** Kansenia.

Bocage's (1895a) record of *africana* from Banks of "Quando River" (? Kwando), Angola, is questionable, the specimen should be re-examined.

Range. Eastern Angola and southern Belgian Congo.

Genus Paratetradactylus

1922b. *Paratetradactylus* Angel, Bull. Mus. Paris, **28**, p. 150, figs. 1–4 (type *ellenbergeri*).

Tongue covered with oblique plicae converging anteriorly towards the median line; nostril pierced between a single nasal, ? first labial, and very near rostral; prefrontals present; frontoparietals present; lower eyelid scaly; dorsal and ventral scales forming straight longitudinal and transverse series; a strong lateral fold; no fore limbs; hind limbs minute; no femoral pores.

Obviously very closely related to *Tetradactylus fitzsimonsi boulengeri*, the sole representative of the monotypic genus *Paratetradactylus* presents a further stage in the process of serpentiform development, except for the retention of prefrontal shields.

Range. Northern Rhodesia.

Paratetradactylus ellenbergeri Angel

1922b. *Paratetradactylus Ellenbergeri* Angel, Bull. Mus. Paris, **28**, p. 151, figs. 1-4: Barotseland, Northern Rhodesia.

Description. Habit serpentiform; fore limbs absent; hind limbs minute, undivided, terminating in a conical scale, length of hind limb less than the horizontal diameter of the orbit; tail about 3.3 times the length of head and body.

Head shields more or less regularly striated; prefrontals broadly in contact; frontal twice as long as broad in middle, longer than its distance from end of snout, longer than parietals; frontoparietals and interparietal present; nuchal scales with from 3 (lateral) to 8 (dorsal) striae but without keels; dorsals striated and with a strong

median keel, in 14 longitudinal and 65 transverse rows; ventrals smooth, in 6 longitudinal rows; femoral pores absent; caudal scales, both above and below, without striae, but with a strong median keel.

Coloration. Above, slightly bluish olive; temples spotted with brown; the two median vertebral rows of keels brown, these lines continuing on to the tail anteriorly. Below, pale olive.

Size. Total length of holotype, 280 (64 + 216) mm.; length of hind limb 2 mm.

Remarks. For further details of this interesting offshoot of *Tetradactylus* of the *fitzsimonsi* formenkreis, consult the original description.

Localities. Known only from the holotype (Paris Mus. 1921–514).

Range. Northern Rhodesia.

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