

EXPLANATION OF THE PLATES.

PLATE XVI.

- Fig. 1. Skeleton of a small *Udenodon*, presumably *U. gracilis*. The parts in outline are from the remains on the counter slab. $\times \frac{1}{10}$.

PLATE XVII.

- Fig. 2. Upper view of skull of *Udenodon gracilis*. Nat. size.
 3. Side view of skull of *Udenodon gracilis*. Nat. size.
 4. Vertebra (probably lower thoracic) of *Udenodon bainii*. Nat. size.
 5. Posterior view of right hind-limb of *Udenodon gracilis*. Nat. size.
 6. Inner view of pelvic bones of right side of *Udenodon gracilis*. Nat. size.

PLATE XVIII.

- Fig. 7. Posterior or under side of right arm-bones of *Udenodon gracilis*. Nat. size.
 8. Right clavicle of *Udenodon gracilis*. Nat. size.
 9. Sternum of Anomodont—believed to be *Udenodon bainii*. Nat. size.
 10. Right shoulder-girdle of *Udenodon bainii*. Nat. size.
 11. Right coracoid and precoracoid of *Udenodon bainii*, from within. Nat. size.

REFERENCE LETTERS.

<i>ac.</i> , acetabulum.	<i>n.</i> , anterior nares.
<i>acr.</i> , acromion process.	<i>na.</i> , nasal bone.
<i>c.</i> , centrale.	<i>ol.</i> , olecranon process.
<i>c.d.</i> , deltoid ridge.	<i>pb.</i> , pubis.
<i>c.e.</i> , external condyle.	<i>ph.</i> , phalanges.
<i>cl.</i> , clavicle.	<i>pi.</i> , pisiform.
<i>co.</i> , coracoid.	<i>p.co.</i> , precoracoid.
<i>f.</i> , femur.	<i>ra.</i> , radiale.
<i>fb.</i> , fibula.	<i>rd.</i> , radius.
<i>fl.</i> , fibulare.	<i>r.f.</i> , frontal ridge.
<i>fm.</i> , femur.	<i>r.p.f.</i> , postfrontal ridge.
<i>fo.</i> , precoracoid foramen.	<i>Sc.</i> , scapula.
<i>f.ob.</i> , obturator foramen.	<i>Sp.</i> , neural spine.
<i>gl.</i> , glenoid facet.	<i>tb.</i> , tibia.
<i>hu.</i> , humerus.	<i>tl.</i> , tibiale.
<i>i.</i> , intermedium.	<i>tr.</i> , transverse process.
<i>il.</i> , ilium.	<i>ts.</i> , tarsalia (1 & 4-5).
<i>is.</i> , ischium.	<i>ul.</i> , ulna.
<i>mt.</i> , metatarsals.	<i>un.</i> , ulnare.

4. On some Species of Earthworms of the Genus *Benhamia* from Tropical Africa. By FRANK E. BEDDARD, F.R.S. &c.

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(Text-figures 12-19.)

The genus *Benhamia* was originally instituted by Dr. Michaelsen¹ and withdrawn from *Acanthodrilus*, in which it had been formerly included. Quite recently² the same authority has proposed to drop this generic name, and has placed the species which belong to it in

¹ JB. Hamb. wiss. Anst. vi. p. 6.

² Oligochæta in 'Das Tierreich,' 1900, p. 334.

the genus *Dichogaster* (originally instituted by myself¹), which has priority. This genus *Dichogaster* was also extended so as to include *Microdrilus*, *Millsonia*, and *Balanta*. The extended genus will contain therefore at the present moment no less than 70 species. If it can be avoided, it appears to me to be undesirable to divide families into such large genera. I do not for a moment deny that the difference between the several types, which were distinct enough at the time of their creation as genera, are through further discovery rendered small. Nevertheless it appears to me to be still possible to retain the genus *Benhamia* (which perhaps must include *Trigaster*) for those Acanthodrilid worms in which the male pores are quite independent at their orifice from the spermiducal glands, and which in all cases (save only in *Benhamia viridis*) open on to a segment (the xviiiith) lying between those upon which open the two pairs of spermiducal glands. But *B. viridis* is not exceptional in the fact that the sperm-ducts are quite independent at their orifice of the spermiducal glands. *Benhamia* is, at least mainly, an African genus—tropical African. Some 38 species are confined to that continent, and two others have been found in the Malay Archipelago as well, while a third has been met with in many parts of the world. Four are, so far as we know at present, confined to the Oriental region, while 9 (exclusive of the species of the genus *Trigaster*) are Central-American and West-Indian. It is held, and as I think rightly held, by Michaelsen that the real home of the genus is tropical Africa, and that there is a great possibility that the species not found within that area have been accidentally transferred. As to the ease with which this may have occurred there is plenty of evidence which I need not recapitulate here. There are, as it appears to me, two strong pieces of evidence in favour of the view that it has occurred in the case of this particular genus, which are these:—firstly, three species are common to Africa and to some other part or parts of the globe; secondly, the species of the genus *Benhamia* of Western Africa are different from those of Central and Eastern Africa. Now migration across the continent must surely be an easier matter than migration so far as the Malay archipelago; we thus are forced to conclude that if so trifling a barrier, comparatively speaking, as the breadth of equatorial Africa has prevented the intermingling of western and eastern species, the enormous tracts of land and sea which intervene between *Benhamia bolawi* in Africa and the same species in other parts of the world must have been traversed by some other means than unaided effort.

(1) *Benhamia moorii*, n. sp.

Mr. Moore has very kindly placed in my hands two specimens of earthworms collected by him in Africa. One of these is well preserved, and is a large and, as I believe, new species of *Benhamia*.

¹ Quart. Journ. Micr. Sci. xxix. p. 251.

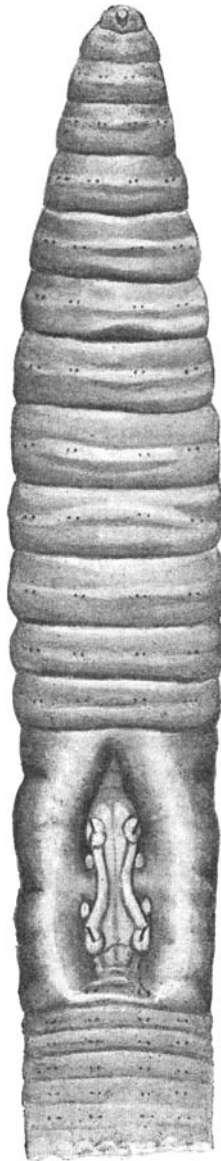
The worm was found upon the Kurungu mountains north of Lake Kivu.

This *Benhamia* is of a leaden colour with a distinct tinge of pink. It is also, on account of its darkly pigmented body, beautifully iridescent. It measures some 280 mm. in length, and is thus one of the larger species of the genus; the extreme diameter (behind the clitellum) is 15 mm.; it is thus a stoutly built worm. Towards both ends of the body it tapers somewhat. As will be seen from the drawing exhibited (text-fig. 12), many of the preclitellar segments are biannulate. The *prostomium* is quite small and entirely retracted within the buccal cavity. It is continued back by a slender prolongation a short distance over the buccal segment. The *dorsal pores* of this worm are apparently rather remarkable in one matter. They commence between segments v./vi., as in many species of the genus. Four plainly obvious pores follow the first one, which is not so pronounced as they are. Then there is a gap where two pores ought to be. It might be imagined that this gap was apparent and not real, due simply to the greater contraction of the body at this part. On dissection, however, the pores were exceedingly plain. And I observed that on the border-line of the three segments, where the dorsal pores were apparently absent, the longitudinal muscle which acts as an expensor muscle of the pore was carried right across the place where the pore should be, instead of ending at its margin as is the case when the pore is present. There seems to be thus no doubt as to the real absence of these pores from the segments mentioned, a curious circumstance which I do not recollect having seen referred to in any other species. Between segments xii./xiii. the pores recommence and continue in an unbroken line to the very end of the body. On the clitellum a median groove partly obliterates the actual pores; it runs from pore to pore and on the anterior part of the clitellum is continuous for some distance; there are traces of it also elsewhere upon the clitellum. It is not a furrowing of the integument, but a slight folding which may of course be due to contraction; and yet this is not certain, since it is the ventral side of this worm which was most contracted, a circumstance which ought to have resulted in a tauter condition of the opposite side of the body.

The *setae*, as is universal in this genus, are strictly paired, and lie entirely upon the ventral surface of the body.

The *clitellum* is fairly extensive. It begins with the xiiith and ends with the xxiiird segment, thus occupying eleven segments. The middle region of the clitellum, including segments xiv.–xxi., is more compacted, owing to a reduction in the depth of the intersegmental furrows. The ventral surface of a considerable portion of this is deeply depressed, as in other species of *Benhamia*, and thus forms a sucker-like structure, extending from about the fifteenth to the twentieth segment. This area surrounds of course the male pores. The arrangement of these will be apparent from an inspection of the drawing exhibited (text-fig. 12). The species shows no great differences from the conditions which have been observed

Text-fig. 12.

Ventral view of the anterior segments of *Benhamia moorei*. $\times \frac{1}{2}$.

and described in other species of *Benhamia*. The four pores of the spermiducal glands lie as usual upon the xviiith and xixth segments. Their position corresponds to that of the ventralmost setæ; from each protrudes a single penial seta, whose structure will be dealt with immediately in connection with that of the male efferent apparatus. A nearly circular fold of integument surrounds each pore, and is continuous with a fold which demarcates a groove putting the two pores of each side of the body into communication. This seminal gutter has a curvature which is not usual in the genus. As a rule it is absolutely straight, or, if curved, the convexity of the curve is to the outside. In the present species the curvature is, as may be seen in the figure, in the reverse direction, the concavity of the curve being directed outwards. Between the two gutters the integument is traversed by a regular series of grooves which subdivide its surface as I have shown (text-fig. 12). I presume that the orifices of the sperm-ducts lie in the groove on each side of the body. But the groove was so deep that I was unable to detect them. Moreover I am unable to assert definitely whether or not the ventral pair of setæ are present upon the xviiith segment. It was thought for a time that the absence of these setæ was distinctive of the genus *Benhamia* (*sensu stricto*); but, as Michaelsen has found that this is not always the case, the character must be dropped: still it remains true that in the majority of species which have been carefully examined these setæ are really absent. On the clitellum generally of this worm, large though it is, the setæ are not at all conspicuous. Just behind each of the anterior penial setæ and just before each of the posterior penial setæ there is, to the side, an isolated and smallish tract of integument which I regard as a *genital papilla*. The two pairs of genital papillæ would thus appear to be situated on the border lines of segments xvii./xviii. and xviii./xix. Although the appearance of the integument which forms these structures does not differ markedly from the appearance of the surrounding integument, yet the groove which surrounds them seems to mark them out as something distinct; and they are, as I think, to be looked upon as genital papillæ, which are sometimes, though not very generally, present in the species of this genus. I could not find either the pores of the oviducts or those of the spermathecæ. As to the latter, a dissection assured me that they are ventral in position and correspond fairly closely to the position of the pores of the spermiducal glands.

Internal Anatomy.

When the worm was cut open, the relative thickness of various regions of the integument was found to vary considerably. Anteriorly to the clitellum the body-wall was much thinner than in the clitellar region and behind it. I may remark that a difference of colour distinguished the two layers of the clitellar epithelium.

Intersgmental Septa.—The considerable deficiency of septa in the anterior region of the body may perhaps account for the thinness

of the integument already referred to. It is very unusual to find so few—and those such thin—septa dividing the anterior segments. Their arrangement, moreover, is very puzzling when taken in relation with the external segmentation and with the location of organs internally. The first recognizable septum is fairly thick and separates segments v. and vi. Its insertion on the body-wall corresponds quite accurately to the external furrow separating those segments. There is then an apparent gap of considerable extent in which there are no septa at all, though the œsophagus and the gizzards are bound to the parietes by a few muscular threads. The next actual septum is very thin; it is inserted behind the last of the two gizzards on to the alimentary canal, but to the body-wall at about the middle of the ixth segment, as mapped by the dorsal pores which are quite conspicuous from the inside of the body. It might therefore be held that the few muscular strands, already referred to, represented the otherwise missing septa vi./vii. and vii./viii., and perhaps viii./ix. Obvious though this determination seems on a dissection, it is apparently not correct. If we count the septa from a fixed point such as the segment lodging, and containing the external orifice of, the anterior spermiducal gland, we find that up to as far forwards as the xivth segment there is a correspondence between the insertion of the septa and the segments which they demarcate. Between the septum which defines the fifteenth segment anteriorly and the second recognizable septum just described, I find six septa crowded together. It seems to follow therefore that that septum, in spite of the place of its attachment to the body-wall, is really septum vii./viii. and that the only really missing septum is vi./vii.

As this latter septum would if present lie between the two gizzards, it is not surprising to find it absent, a state of affairs which is very characteristic of the gizzard segments of *Perichæta* (syn. *Amyntas* and *Pheretima*).

None of the septa as already mentioned are particularly thick; those dividing segments xii./xvii. are the most developed.

Alimentary Canal.—The *pharynx* occupies the first five segments of the body. The two *gizzards* are separated by a very short tract of thin-walled œsophagus. The anterior of the two gizzards is really preceded by a third rather rudimentary gizzard, for the walls of the end of the œsophagus are nearly as thick as those of the gizzard and are divided from it by a brief thin-walled region. From what has been said with regard to the septa of this part of the body, it should be clear that the two fully developed gizzards lie in segments vi. and vii., a quite reasonable determination of their situation. Segments v. and vi., however, are more usually occupied by the gizzards in this genus. The *calciferous glands* are in segments xv., xvi., and xvii. The first pair differ from the rest in being whiter in colour. Each gland is somewhat kidney-shaped but with a number of transverse depressions dividing it into lobules. The glands open separately into the œsophagus, by wide and easily visible ducts.

Generative organs.—The *testes* I did not detect. The *ovaries* were very small, though easily recognizable in their usual segment (the xiiith). There are two pairs of *funnels*, which seem at first sight to be situated farther forward than is the rule; they lie in fact beneath, and are quite concealed by, the large gizzards. The shifting of the septa, however, already referred to, accounts for this appearance; and I have little doubt but that the funnels lie in segments x. and xi. They are large, much folded, and of an opaque, white colour as is usual with the funnels of the terrestrial Oligochæta. The *sperm-sacs* are apparently but slightly developed, that is if I am right in my identification of these structures. In segment xii. and attached just behind the posterior pair of funnels to the septum near to the ventral body-wall, is a pair of small pear-shaped bodies which I took at first for *testes*, so small are they, and of so unusual a form for sperm-sacs. Nevertheless I imagine that they must be sperm-sacs, though I could make out nothing decisive in their structure when teased in glycerine. A second pair of apparently similar sacs lie above them and protrude into their segment through an obviously natural foramen in the septum. A series of sections enable me to state definitely that these are sperm-sacs. The *spermiducal glands* are large and much coiled, so that they occupy only two or three segments. They appear, however, above the gut in this region. The muscular duct in which they end is thinnish and of some extent.

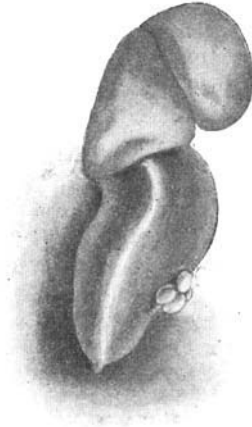
This *Benhamia* has the usual two pairs of *spermathecae*, which are large and completely hidden by the gizzards; their external orifices are, however, between segments vii./viii. and viii./ix. Each sac (text-fig. 13, p. 197) consists of a thin-walled receptacle of somewhat irregular form owing to its being not very full of secreted matter, and to unequal pressure by the other viscera in the preserved worm. Leading from this pouch is the thick-walled and more muscular duct, which is quite of equal length to the pouch. Attached to the duct nearer to its external opening than to the pouch is a single diverticulum, which is composed of a rosette of flattened seminal chambers which are chalk-white from the enclosed semen.

Penial Setae.—It is rather extraordinary that the very fragile penial setæ were absolutely intact. Protruding from each of the four spermiducal gland-apertures was a single long penial seta of a brown horn-colour, and some four or five millimetres long. That they were protected by the deep depression in which the male orifices lie is possibly the cause of their preservation; for I found them very brittle. These four setæ stand up perfectly straight without a bend, except at the very tip, which is hooked. It is a curious fact that they were symmetrically disposed; each pair stood as it were back to back, with the hooks directed outward. I do not think that this regularity in the position of the penial setæ has been commented upon before.

The appearance of these setæ under the microscope (see text-fig. 16, p. 205) is characteristic. Very nearly the whole of that part of the seta which is exposed at the surface of the body is marked

by complete rings of a different texture, or at least appearance, to the interspaces. It can be readily seen that these rings are not superficial markings upon the seta, as they have been—perhaps wrongly—stated to be in the case of similar seta in other worms. They are, as was correctly stated by Michaelsen in another species of earthworm, caused by some differentiation of the material of the

Text-fig. 13.

Spermatheca of *Benhamia moorei*. $\times 3$.

seta below the outermost layer. Towards the hooked end of the seta these rings get to be closer together and at the same time of less diameter. In addition to these markings the extremity of the seta is pitted—this time quite superficially—with minute excavations. The tip is strongly hooked, and before this the seta regularly but rapidly decreases in calibre, not suddenly as Michaelsen has figured and described in *Benhamia itiolensis*.

Spermatophore.—I found a spermatophore in this species; but I do not give a full account of it, and as the existence of spermatophores in this genus is not my discovery, I do not give a special section to an elaborate description of it. It is curious how rarely spermatophores have been met with in the enormous number of species (some 550) belonging to the family Megascolicidæ (from which I exclude the Eudrilidæ). Indeed I am only acquainted with their description in two forms belonging to the same genus as the subject of the present communication. Dr. Michaelsen has in fact figured and briefly noticed a spermatophore in *Benhamia monticola* and *B. itiolensis*¹. The spermatophore of the species described here is apparently slightly different in form. I may remark first of all that it lay entirely in the muscular duct of the spermatheca, and

¹ Regenwürmer in Deutsch-Ost-Afrika, p. 28, pl. i. fig. 4.

that it is too large to have been moulded in the narrow muscular part of the spermiducal gland. The end turned towards the spermatheca was oval in form, and this region gradually narrowed and then terminated abruptly in a large roughly rounded mass, of greater diameter than the oval end of the spermatophore. The structure was very hard, and a little brittle, and of the usual chitin yellow. When viewed with the naked eye, or with a lens, the distal end of the spermatophore was white from the enclosed sperm. The finer middle region was of a golden yellow, since the canal here within the spermatophore was narrow. The walls are thick, especially of course those of the rather irregularly shaped terminal swelling. Whether there is a terminal pore I do not know.

I conclude with a brief definition of this new species, which I propose to name after Mr. Moore:—

Benhamia moorei, n. sp.

Length 280 mm., *diameter* 10–15 mm. *Prostomium* very small, prolonged for a short way on to the buccal segment. *Dorsal pores* commence v./vi. *Clitellum* xviii.–xxvii. *Male pores* on deep depression; *seminal gutter* convex inwards. *Two pairs of genital papillæ* on xvii./xviii. and xviii./xix. *Gizzards* in vi. and vii.; *calciferous glands* in xv., xvi., xvii., opening separately into oesophagus. *No septa* very thick; *septum* vi./vii. wanting. *Dorsal vessel* single; *last heart* in xvi. *Two pairs of sperm-duct funnels*. *Spermiducal glands* large and coiled. *Penial setæ* one to each gland, hooked at the tip and marked throughout the greater part with fine rings; at the very tip very slightly pitted. *Spermathecae* with long muscular duct as long as the pouch. *Near to the beginning of the muscular duct* a rosette of four or five diverticula. *Spermatophores* present.

Hab. Kurungu Mts., East Central Africa.

(2) **Benhamia johnstoni**, n. sp.

Sir Harry Johnston, K.C.B., has sent to the Natural History Museum three Earthworms which prove to be all of the same species, and are closely allied to *B. moorei* which has just been described. I am indebted to the kindness of Sir Harry Johnston as well as to Dr. Lankester for allowing me the opportunity of examining these worms. The species, which I propose to name after their collector, is in many respects so near to *B. moorei*, that at first I thought that I had before me some larger examples of that species. Nevertheless, as I shall show, there are a number of points of structure in which the two differ.

B. johnstoni is a larger worm, though its actual length is less than that of *B. moorei*; the largest of the three specimens was 250 mm. in length, but quite 20 mm. in breadth, indeed a millimetre or two more in places. It is thus an exceptionally stout species. The colour during life must have been very marked; even in the preserved worms the contrasts of colours are striking. The general colour above is of a red-brown, which pales into a yellowish upon the ventral surface. The dorsal

pores are surrounded by a small pale area and the clitellum is yellowish.

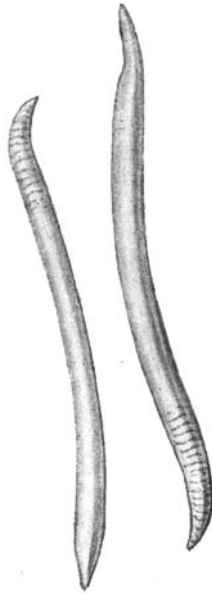
The *prostomium* is larger than that of *B. moorei*; it is retracted within the buccal cavity, and is divided off from the buccal segment by a complete groove which dips faintly into the segment. The arrangement of the prostomium is that denominated "propilobisch" by Dr. Michaelsen. It is convenient to have terms for the varying condition of the prostomium which is so frequently of use in the discrimination of species or genera, as in the present instance. But it would be as well perhaps to convert Michaelsen's terms into more purely Greek compounds. I would suggest that the terms should be epicheilous, &c. The *dorsal pores* have an interesting arrangement in this species. In one of the three examples no pores were missing from the intersegmental groove v./vi. onwards. In another, one was not visible externally and internally, the muscles, which are present in every case, running from margin to margin of the successive pores, were exceedingly feeble at this point. In the third example, which I did not open, there was no doubt of the fact that the *dorsal pores between segments x./xi. and xi./xii.* were absent; for in that worm the other pores happened to be particularly conspicuously distended. There is thus in the present species a series of stages which culminates in the loss of the two dorsal pores immediately preceding the clitellum. In *B. moorei*, as has been stated, the same pores are absent; but it may be of course that other examples would show some trace of their presence. I should observe that the muscles whose function it is to distend the pores are exceptionally well developed in this species, and that the feeble muscles running from the places which should be occupied by the missing dorsal pores ended where the pores should be, and did not, as in *B. moorei*, continue their course over this spot without a break.

The *setæ* have the usual strictly paired and ventral position. The individual setæ are very plainly ornamented, as is the case with other species; the ornamentation is in the form of slight ridges over the distal end of the seta. The seta as a whole is rather straight, and has often a somewhat peculiar ending in its epidermic sac, which is illustrated in the accompanying drawing (text-fig. 14, p. 200). The setæ cannot be considered to be small except proportionately, the worm being exceptionally large.

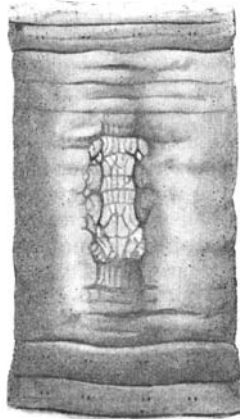
The *clitellum* is largely composed of segments whose mutual demarcations have been to a great extent obliterated; but in front of, and behind, this region are two segments which belong to the clitellum, though they are not so thoroughly amalgamated with the middle segments as the latter are with each other. The clitellum extends from segment xii. to xxiii. inclusive, and is thus longer than that of *B. moorei*. The ventral surface which bears the several male pores is deeply depressed as shown in the drawing (text-fig. 15, p. 200).

The figure of *B. moorei* shows the tessellated appearance of the integument in the region of the male pores; this appearance is

Text-fig. 14.

Two setæ of *Benhamia johnstoni* (highly magnified).

Text-fig. 15.

Ventral surface of clitellar segments of *Benhamia johnstoni*. $\times \frac{1}{2}$.

exaggerated in the present species (text-fig. 15, p. 200), the condition of the integument somewhat obscuring the actual orifices of the spermiducal glands. The penial setæ projected from the latter precisely as in *B. moorei*. The groove which connects the two spermiducal gland-pores of each side is straighter than in *B. moorei*, and in the two not fully mature examples was perfectly straight. The groove itself is a little difficult to see owing to the numerous lines which divide up the ventral area into detached tracts.

The internal structure of this worm also shows a few small differences from both *B. moorei* and *B. itiolensis*. The two gizzards are so close together that it is difficult to note their line of division. Moreover strands of muscle pass over this line of division. I am disposed to believe that the gizzards lie respectively in segments vii. and viii. It is rather hard to be certain upon this point; but in any case I counted six septa in front of that which divides segments xiv./xv. In front of the last of these six septa lies the posterior of the two gizzards. It cannot therefore be behind the viiith segment, though it is possible that the gizzard really lies in vii. as in *B. moorei*. The calciferous glands are in segments xv., xvi., xvii. They differ slightly from those of *B. moorei*, in that the first and the third pairs are equal, while the middle pair are rather the smallest. I observed no difference of colour such as distinguishes the first pair of these glands in *B. moorei*. The intestine in this species commences in segment xix. There is apparently no difference from *B. moorei*, as far as I can see, in this particular.

The organs of reproduction are, moreover, much the same. I found, as in *B. moorei*, masses of sperm in segments xi., xii. I could find no wall to these masses, which seemed to be merely floating and agglomerated heaps of developing spermatozoa freed from the testes. I have adverted to the very small size of the sperm-sacs in *B. moorei*. In the present species I could not discover them at all; they must therefore be small if present. It is remarkable that in mature examples of both species the sperm-sacs are so small, and that both concur in having large and freely floating masses of sperm. In *B. itiolensis*, Michaelsen was unable to record the position and appearance of the sperm-sacs; while in *Benhamia viridis* and *Trigaster lankesteri* the sperm-sacs, dwindling as it appears in the former three species, have entirely disappeared. The spermiducal glands are very large and massive. Each of them occupies two segments, the connection between the two masses being by a single loop of the tube which perforates the septum; thus the appearance of four pairs of glands is produced. The arrangement is obviously not quite the same as has been figured by Michaelsen in *B. itiolensis*. But in the so-called variety *cœrulea*, the same arrangement as that characteristic of *B. johnstoni* appears to occur. The penial setæ of the present species are quite different in form from those of *B. moorei*, as will be seen from a comparison of the accompanying drawings (text-fig. 16, p. 205). The general form and the remarkable straightness is the same in

both, as is the series of transverse bars which mark the setæ throughout. At the distal end, however, there are plain differences. In *B. johnstoni* the seta swells ovally just before its termination, and on the ventral side of this there is a sharply marked ridge; the actual extremity is bent almost like a crozier, the end lying parallel with the main shaft; the very tip is slightly bifid. It is clear that this does not agree with the figure given by Michaelsen of *Benhamia itiolensis*. Nor does his description of the penial setæ of the variety *cærulea* fit itself to what I have observed. Of the seta in *B. itiolensis* var. *cærulea*, he remarks that it has a much narrower distal extremity (as in *B. johnstoni*), and that there is also an oval swelling which precedes this terminal hook (also as in *B. johnstoni*); but the tip is apparently not so much hooked as in *B. johnstoni*, and no mention is made of the bifid extremity.

The two species *Benhamia johnstoni* and *B. moorei* evidently come near to *B. itiolensis*¹. But they both differ in a number of recognizable features from that large and also Eastern African *Benhamia*. To begin with, *B. itiolensis* is distinctly larger, it measures 380 mm. Its colour seems to be somewhat different. The anterior segments are some of them triannulate instead of biannulate, as is the case with the species described in the present paper. Nothing is said by Michaelsen of the missing dorsal pores; but in a variety of the type named by him var. *cærulea*, the pores are stated not to begin until the intersegment xii./xiii. The clitellum of *B. itiolensis* is more limited than in its allies; but the seminal gutter is convex inwards as in those two species. At least that is not the case with the type itself, but with the form *cærulea*. The spermiducal glands of *B. itiolensis* are very much smaller than those of *B. johnstoni* or *B. moorei*, though their size appears to be increased in the var. *cærulea*. The penial setæ as figured by Michaelsen are more like those of *B. johnstoni*, but the hooking of the extremity is more marked in the latter form; moreover, no ornamentation is described. In var. *cærulea* the extremity of the seta is more hooked, and therefore more like that of *B. johnstoni*. Finally, *B. itiolensis* has no free diverticula to the spermathecæ, a feature which is so obvious in the species described by myself that Michaelsen would hardly have overlooked it did it exist in his *Benhamia itiolensis*. The differences between many species of this genus (which requires revision) are often so small, that a very careful and detailed statement of the characters is necessary. For this reason I have not hesitated to deal with my supposed new species at considerable length.

It may be convenient to contrast the characteristics of the four species in a tabular fashion. I shall consider the variety *cærulea* to rank as a species; its differences from *B. itiolensis* are quite as great as those which divide many other recognized species of the genus.

¹ Michaelsen, "Beschreibung der von Herrn Dr. Fr. Stuhlmann am Victoria Nyanza gesammelten Terricolen," JB. Hamb. wiss. Anst. ix. p. 3; *ibid.*, xvi. p. 116; Regenwürmer in Deutsch-Ost-Afrika, iv. p. 25; Oligochæta in Thierreich, 1900, p. 360.

	<i>B. itiolensis.</i>	<i>B. cœrulea.</i>	<i>B. moorei.</i>	<i>B. johnstoni.</i>
<i>Prostomium</i>	<i>Proepicheilous.</i>	<i>Epicheilous.</i>	<i>Epicheilous.</i>	<i>Proepicheilous.</i>
<i>Anterior segments</i> .	<i>Triannulate.</i>	<i>Biannulate.</i>	<i>Biannulate.</i>
<i>Dorsal pores</i>	<i>v./vi.</i>	<i>xii./xiii.</i>	<i>v./vi.</i>	<i>v./vi.</i>
<i>Clitellum</i>	<i>xiv.-xxii.</i>	(?)	<i>xiii.-xxiii.</i>	<i>xii.-xxiii.</i>
<i>Seminal gutter</i> ...	<i>Straight.</i>	<i>Convex inwards.</i>	<i>Convex inwards.</i>	<i>Convex inwards.</i>
<i>Gizzards</i>	(?)	<i>viii. & ix. (?)</i>	<i>vi., vii.</i>	<i>vii., viii.</i>
<i>Calciferous glands.</i>	<i>xv. smallest.</i>	<i>xv. smallest.</i>	<i>xv. smallest.</i>	<i>xvi. smallest.</i>
<i>Spermathece</i>	<i>No extern. div.</i>	<i>No extern. div.</i>	<i>Extern. div.</i>	<i>Extern. div.</i>
<i>Penial setæ</i>	<i>Suddenly diminish into slightly curved hook.</i>	<i>Suddenly diminish into slightly curved hook.</i>	<i>Gradually diminish into slightly curved hook.</i>	<i>Suddenly diminish into very curved hook.</i>

From the above account of its structure I can abstract the following definition of the species which, I may remark, contains certain statements not described in any further detail in the foregoing.

***Benhamia johnstoni*, n. sp.**

Length about 250 mm.; *diameter* 15-20 mm. *Prostomium* rather large, retracted within mouth-cavity, not prolonged over buccal segment, but with slight median projection. *Dorsal pores* commence v./vi. *Clitellum* xi.-xxiii. *Male pores* on deep depression; *seminal gutter* slightly convex inwards. *Integument* surrounding male pores markedly tessellate. *Gizzards* in vii., viii.; -*calciferous glands* xv., xvi., xvii., opening separately into oesophagus; middle pair the smallest. *No septa* very thick. *Dorsal vessel* single; *last hearts* in xvii. *Spermiducal glands* lie in two masses in two segments each. *Penial setæ*, one to each gland, slightly swollen before strongly hooked tip, which is bifid at extremity, marked throughout with fine rings. *Spermathece* with strong muscular duct longer than pouch, into the duct opens a rosette of five or six diverticula.

Hab. Ruwenzori, 6500 ft.

(3) ***Benhamia mollis*, n. sp.**

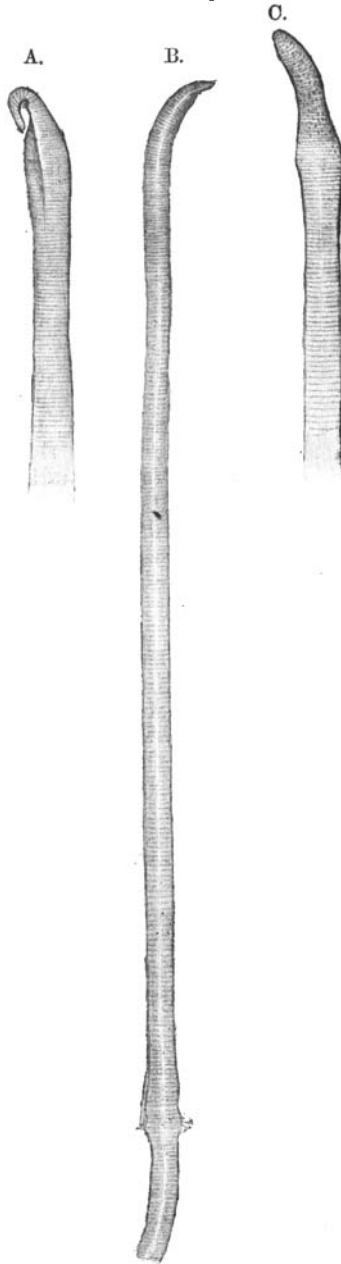
In the above table of the specific distinctions between the species *B. johnstoni*, *B. moorei*, *B. itiolensis*, and *B. cœrulea*, I have not included the characters of a second species of *Benhamia* placed in my hands by Mr. Moore. This worm is of a very dark brown colour and is very soft. I naturally put down this softening to inferior preservation; but Mr. Moore informs me that the living worm was exceeding soft and that the specimen which I have examined is in reality as well preserved as is the type of *B. moorei*. I have not compared its characters in a tabular form with those

of the other species for the reason that, although I believe it to be a distinct form, it is not easy to define by marked characters as can be made use of in such a table, and indeed it comes very near to *B. johnstoni*.

It is, however, a smaller and more slender species than is the last named. My example measured some 205 mm. in length by a diameter of about 7 mm. There is the same curious absence of two dorsal pores from the preclitellar series that is so noticeable in *B. moorei* and *B. johnstoni*.

The genital area is a deep excavation; and the integument in this region is tessellated in appearance, being divided up into numerous small areas by grooves. The seminal gutters are nearly straight, only slightly bulging inwards. The single penial seta, as in the other species, projects from the apertures on segments xvii. and xix. The clitellum is a little less extensive, and seems to occupy only segments xiv.-xxii. I am sure that the ventral setæ of segment xviii. are wanting, and this adds probability to their apparent absence in the other two species of which the present memoir treats. As in *B. johnstoni*, the middle pair of calciferous glands are the smallest of the three pairs. The glands are somewhat flattened from side to side, more so than in *B. johnstoni*, and much more so than in *B. moorei*. The intestine begins in segment xix. The two gizzards are certainly in vii. and viii.; the same segments apparently are occupied by the gizzards in *B. johnstoni*. The last heart is in xii. The sperm-sacs in this species were more in evidence than in the other two species of *Benhamia* dealt with here. They lie in segments xi., xii., and are somewhat elongated transversely, curving up in a somewhat horn-like fashion. The penial setæ of *B. mollis* are recognizable as different from those of the other two species. The setæ of all three species are figured in the accompanying drawing (text-fig. 16, p. 205). It will be noticed that their structure is intermediate between that of the penial setæ of *B. moorei* and *B. johnstoni*. As in the former, the distal end of the seta is not very strongly curved; as in the latter, the shaft of the seta is swollen before the terminal hook. But the swelling is not so marked a feature of the setæ of the present species. Nor is the difference in diameter between the hook and the rest of the seta so suddenly changed. Moreover, the markings upon the end of the seta which appear to be of the nature of pits are much more pronounced in *B. mollis* than in its allies. No one, after inspecting the figures referred to, can doubt the difference of the penial setæ in the three species. The spermiducal glands are, as in *B. johnstoni*, contained each in two segments, one half or thereabouts of the gland lying in each segment. The junction between the two is a single tube, i. e. the gland only perforates the intersegmental septum once. The spermatheca are most like those of *B. johnstoni*. The muscular duct of the spermatheca is humped on one side, where a series of five or six inconspicuous diverticula debouch into the duct. The diverticula are less separated from the tube into which they open than they are in *B. moorei*.

Text-fig. 16.



Penial setae of *Benhamia* (highly magnified).
A, distal extremity of that of *B. johnstoni*; B, seta of *B. moorei*;
C, distal extremity of that of *B. mollis*.

It must be admitted that the principal reason for separating this species from *B. johnstoni* is the character of the penial setæ. It is, however, a smaller species, with a different coloration. As to the clitellum, it is possible that other specimens would show an extension equal to that of *B. johnstoni*.

(4) *Benhamia austeni*, n. sp.

I am indebted to the kindness of Mr. Austen for kindly collecting for me a considerable number of specimens of a species of *Benhamia*, which I believe to be new. The worms were collected about forty miles from Blantyre in Nyassa-land.

The species is not a large one, but I cannot give accurate measurements of length as the worms were rather softened. I should say that a length of 150 mm. by a diameter of 5 mm. was a fair statement of their dimensions.

The setæ have the usual strictly paired and ventral arrangement. Those of the three or four anterior segments are smaller than those which follow; they gradually increase in size, and the larger ones show a distinct ornamentation in the form of ridges which produce a scale-like appearance—a form of ornamentation found in other species of the genus. On segments vi.–ix. or so the setæ are especially enlarged; it will be noted that these segments are in the neighbourhood of the spermathecal pores, and the strong pairs of setæ on the segments between which those pouches open are particularly noteworthy. It is only the ventral setæ which are thus specially enlarged. Now it will be remembered that in *Benhamia liberiensis*¹ there is a similar enlargement of the ventral pair of setæ of segment vii. But in this species the setæ when extracted are seen to be quite as much modified as are the genital setæ of segments xvii. & xix. in the same and other species of *Benhamia*. This is not the case with *Benhamia austeni*; but the enlargement and increase of the ornamentation upon the setæ is a step in that direction. The circumstances are exactly paralleled by the slightly modified setæ in the neighbourhood of the male pores in certain species of *Perionyx*², which in the allied genus *Megascolex* become the much more modified penial setæ.

There are no ventral setæ upon segment xviii.

The dorsal pores commence between segments v./vi. They appear to go on without intermission to the end of the body. No such break as I have described in *Benhamia moorei* seems to exist.

The oviducal pores are paired. Each pore lies on the fourteenth segment to the inside of, and quite in line with, the ventralmost seta; it looks, on an inspection by a lens, precisely like a third seta in this position, by reason of its dark appearance.

It is important to note the position of the oviducal pores, which vary in the genus, and would appear to offer characters of specific

¹ Horst, "Descriptions of Earthworms: IX. On two new *Benhamia*-species from Liberia." Notes Leyd. Mus. xvii. p. 21.

² Beddard, "On some new Species of Earthworms from various Parts of the World." P. Z. S. 1892, p. 688.

value by this variation in position. For example, in *Benhamia crassa* the pores lie in front, though also slightly to the inside, of the ventralmost seta.

The *clitellum* extends from segments xiii.-xx. and leaves only the area which is occupied by the male pores free. The latter lie upon the segments which they universally occupy in this genus. The seminal groove which connects the two successive pores of each side of the body is quite straight.

The internal anatomy is like that of the genus, and only shows some slight differences from other species. The *septa* which divide segments x./xiv., *i. e.* four septa, are specially thickened.

The *gizzards* occupy segments v. & vi. The *calciferous glands* are in segments xv., xvi., xvii. The glands are bean-shaped, and the upper surface is traversed by a few longitudinal furrows, which divide the glands into segments.

The last pair of *hearts* are in the twelfth segment, and the *dorsal vessel* is throughout a single tube.

The *sperm-sacs* are in the same segments as those of the last species described, *i. e.* xi. & xii. They are large and racemose. There is no doubt that this species, like at any rate some others, has sperm-reservoirs also which enwrap the funnels and testes. I cannot attempt an accurate description of them, but can assert that a pair project forwards, just as these pouches generally do when they are present, into the xth segment.

The *spermiducal glands* are fairly long and coiled; I occasionally observed the posterior pair to be the smaller. The muscular terminal duct is longish. The glands lie in two segments. The shape of the *penial setæ* of this species is quite peculiar for the genus, and would serve at once to distinguish it, if there were no other characteristics. One of the setæ is shown in the drawing exhibited (text-fig. 17, p. 208). Its shape is, as will be seen, straight in the shaft like that of the other East-African species already dealt with here. The end imbedded in the body-wall is curved slightly and thicker. The opposite extremity of the seta is also curved and in the same direction: it does not end in a very fine point but diminishes gradually and not very much in width. The termination is therefore a blunt point. It is the ornamentation of the genital seta which is so characteristic. This consists of two rows of spines which commence about half-way down the seta or a little less. They appear to be much like the penial setæ of *Stuhlmannia variabilis*¹ figured by Michaelsen. In two setæ which I examined I found slight differences in the arrangement of these spinelets; in one which I have selected for figuring the two rows ran to the end of the seta, and between them not far from their origin are indications of a third row consisting of two separated tracts of spinelets. In another example this middle row ran to the end of the seta, and the lateral row of one side ceased a little way from

¹ "Beschreibung der von Herrn Dr. Fr. Stuhlmann auf Sansibar, &c." JB. Hamb. wiss. Anst. ix. 1891, pl. ii. fig. 12.

Text-fig. 17.**Penial seta of *Benhamia austeni* (highly magnified).**

its commencement. I may add that each seta-sac contained only one seta, as in the other East-African species.

The *spermathecae* of this species lie in segments viii. and ix. Each consists of a thin-walled sac and of a duct. Into the commencement of the latter opens a single diverticulum. The thin-walled sac is divided by a constriction into two unequally sized chambers, of which the upper is the larger. Its diameter exceeds that of the duct. The smaller division is of about the same diameter as the duct, and without a microscopical examination might therefore be confounded with the duct. The great thickness of the muscular walls of the latter serve to distinguish it easily. Also the character of the lining epithelium. The duct of the spermatheca is of about the same length as the pouch; its walls are, as already said, very muscular, which gives to them a nacreous appearance. The muscles are disposed in two layers of which the thicker and internal layer consists of circular fibres. The outer thinner layer is made up of longitudinally running fibres. The diverticulum is an oval, almost spherical, pouch, which is appended to the spermatheca by a short and slender duct. This opens into the spermatheca just at the junction of the thin-walled pouch with the thick-walled duct. It might appear from my figure of the spermatheca of *Benhamia moorei* (text-fig. 13, p. 197), that this species differs from *Benhamia austeni* by the fact that the diverticula open into the muscular duct itself, and at some little distance from the union of the duct with the pouch; this is, however, not the case, as I have assured myself by microscopic sections of the spermatheca of *B. moorei*. In that worm the diverticula are certainly appended to the muscular duct itself; but the tubes which put them into communication with the interior of the spermatheca run upwards (*i. e.* away from the external pore) and open into the commencement of the thin-walled portion of the spermatheca, which, however, in this species is rather thicker-walled (in correspondence with its larger size) than the corresponding portion of the spermatheca of *Benhamia austeni*.

I may extract from the foregoing the following definition of

***Benhamia austeni*, n. sp.**

Length about 150 mm., diameter 5 mm. Dorsal pores commence v./vi. Clitellum xviii.-xx. Male pores on a deep depression connected by a straight seminal gutter. No genital papillae. Gizzards in v., vi.,; calciferous glands in xv.-xvii. Septa x./xiv. thickened. Dorsal vessel single; last hearts in xii. Two pairs of sperm-duct funnels. Spermiducal glands large and coiled. Penial setae with two rows of spinelets, one to each sac. Spermathecae with long muscular duct and a single stalked spherical to oval diverticulum. Spermatophores¹ present.

Hab. Near Blantyre, East Africa.

¹ I intend to describe these structures, which differ from those of *Benhamia moorei*, later.

I am indebted to Mr. Budgett, of Trinity College, Cambridge, for a number of specimens of Earthworms from McCarthy Island in the Gambia, which he collected during a recent visit. The specimens were at first put aside under the impression that they belonged to a species recently characterized by myself as *Benhamia budgetti*¹. A further examination has, however, shown that they are not of that species, but represent two other species of the same genus upon which I propose to offer some notes. The preponderance of the known species of this genus are of West-African habitat, some 25 having been described from that part of the continent; there are some 18 East and Central African forms.

The species of this genus are not at all easy to identify, and there is a group of West-African forms to which the specimens described in the present paper belong which are all characterized by the calciferous pouches usually lying in the xivth to the xvth segments, and of a form like the "quarter" of an orange; by spermathecae unprovided with an externally visible diverticulum, the anterior pair being often the smaller; and often by genital papillæ in the neighbourhood of the male pores. This group contains the species *B. buettikoferi*, *B. horsti*, *B. beddardi*, *B. stampflii*, *B. schlegelii*, *B. liberiensis*, and *B. budgetti*. To the first of the new forms described here I shall give the name of

(5) *Benhamia gambiana*, sp. n.

I have examined three examples all of which were sexually mature. The length of the worms, which were somewhat softened in condition, was about 170 mm.; the diameter not more than 5 mm. except in the more swollen clitellar region.

The *prostomium* is rather broad and does not notch the buccal segment; it belongs to the type termed "prolobisch" by Dr. Michaelsen, but which I prefer to call "procheilous."

The *setae* are in closely approximated pairs, and, as is the case in this genus, lie upon the ventral surface of the worm.

The *clitellum* occupies segments xiii.-xx., and is not developed upon the ventral area which bears the genital orifices of the male system. The latter part was to be distinguished from the yellow clitellum by its grey colour.

The *seminal gutters* uniting the two orifices of the spermiducal glands of each side of the body are bracket-shaped, the main portion of each being perfectly straight and only bending inwards and that at right angles at each end, where it becomes confluent with the aperture of the spermiducal gland. This species has a number of very conspicuous *genital papillæ* in the neighbourhood of the male pores. These lie intersegmentally, and in the intersegments xv./xvi., xvi./xvii., xviii./xix., xix./xx. One pair of papillæ therefore lie within the genital area. A remarkable fact about these papillæ is that although paired their mutual distance (of each pair) increases gradually in successive papillæ commencing with the

¹ Proc. Zool. Soc. 1900, p. 653.

earliest. Thus those of xv./xvi. are quite in contact, and finally the last pair, those on the intersegment xix./xx., are farther apart than are the ventralmost setæ of the neighbouring segments. Papillæ with the arrangement just described were only found in one example; in another the intersegment xv./xvi. bore but a single median papilla which was followed by only two pairs, *i. e.* intersegments xvi./xvii. and xix./xx. A third example had still fewer papillæ, the anterior pair or single papilla, as the case may be, having disappeared. In this specimen there are, therefore, only two pairs of papillæ.

I observed that the *oviducal pores* lie on a level with and to the inside of the ventralmost seta of each side. The *male pores* and the *spermathecal pores* correspond in position to the ventral pair of setæ.

In a third individual, which was rather more contracted in the clitellar region, the papillæ have become also contracted and look like half-closed eyes lying between segments xv./xvi., xvi./xvii., and xix./xx. They are not obvious, and might be missed by anyone who had not seen them in a more fully expanded worm.

The *dorsal pores* of this species, as of *B. budgetti*, are by no means plain. They appear to be quite absent in front of the clitellum, and behind the clitellum I could only see them by examining microscopically pieces of stripped-off cuticle. The condition of the dorsal pores in this species shows how careful one should be in stating the absence of these structures. The internal anatomy of this species shows very few characters of difference from its allies. The two *gizzards* are separated from each other by a considerable tract of soft-walled œsophagus; there is not that close connection between the two gizzards that obtains in some other species—for instance in *Benhamia johnstoni*. The position of these gizzards is perfectly plain in one specimen; they lie in the vth and vith segments. In others it appeared to me that the vith and viith segments were those occupied by the gizzards; but in view of the very clear appearances shown in the individual (that with a contracted clitellum) where they were to be relegated to segments v. and vi., I imagine that the thin septum dividing segments vi. and vii. had escaped my attention. The *calciferous glands* lie in segments xiv., xv., xvi., as in many of these West-African species of the genus. The anterior pair were smooth and smaller than the others, whose superior surface is broken up by a few transverse grooves; the shape of the glands is that of a segment of an orange, the top being flat. I have not ascertained whether they open separately into the œsophagus or by a common duct. The *intestine* begins in segment xix. It is noticeable that when the calciferous glands are in segments xv., xvi., xvii., the commencement of the intestine is at least sometimes not thrown a segment farther back.

The *dorsal vessel* is single, and the last *hearts* lie in segment xii. The *sperm-sacs* are large and lie in segments xi. and xii. There are also two pairs of sperm-duct funnels which are in x. and xi.

The *spermiducal glands* are confined each to its segment (the xviii and xixth). These glands have a rather short muscular duct which is not half the diameter of the glandular tube. The latter is only bent upon itself once or twice; there is no complicated coiling such as occurs in many species. The anterior spermiducal glands are rather the smaller. The *penial setæ* are about 1.25 mm. in length. Each sac contains two of these setæ equally developed. The two setæ are of precisely the same form, there being no differentiation of the penial setæ such as characterizes many species. Each seta is gracefully curved in an elongated S. It

Text-fig. 18.

Extremity of penial seta of *Benhamia gambiana* (highly magnified).

diminishes in breadth at the free end, but not suddenly or markedly. For a little distance before the end it is covered with fine spinelets. The actual end of the seta seems to be excavated on one surface, as is shown in the accompanying drawing (text-fig. 18); the outlines of this terminal excavation are plainly to be seen. The tip of the seta is somewhat expanded in a way reminiscent of the "cap" which covers the penial seta of *Benhamia horsti*¹. This region has a granular appearance.

¹ "Ueber eine neue Gattung und vier neuen Arten der Unterfamilie Benhamini," Mitth. Naturh. Museum, Hamburg, xv. p. 11, fig. 3.

The two pairs of *spermathecae* occupy the usual position that characterize this genus. The anterior pair of pouches are rather the smaller. Each consists of a roughly spherical pouch which is almost sessile upon the body-wall; external diverticula are not visible. But a microscopical examination shows a cavity filled with sperm within the walls of the organ.

(6) *Benhamia michaelsoni*, n. sp.

Of this species, also new, which comes from the same locality as the last, I have had but a single specimen for examination, which proves, however, to be fully mature. It measured 200 mm. in length by 5 mm. in diameter. It is thus of much the same size as the last, and has *B. budgetti*, *B. beddardi*, and *B. horsti* among its nearest allies.

The *setae*, which show the usual paired arrangement, are smaller upon the first few setigerous segments and gradually increase in size up to the fifth (setigerous) segment. A distinct ornamentation can often be traced in the form of transverse rings.

The *genital area* is much more deeply sunken than in the last species. The arrangement of the *genital papillae* is also different. But in *B. michaelsoni*, as in *B. gambiana*, the *seminal gutter* is straight. The only two *genital papillae* that I could find are situated respectively on the border-lines of segments xxi./xxii. and xxii./xxiii.; each papilla is small and round and perfectly obvious; it lies exactly in the middle ventral line of the body. In the neighbourhood of the male pores the integument is swollen here and there into papilla-like outgrowths; but I do not put these down under the category of papillae, since they are not so plain and unmistakable as are those which I have just described. Where the area surrounding the male pores is depressed, there are usually such inequalities in the surface of the integument. These naturally produce, as they do in the present species, a chequered surface upon the cuticle when this is viewed after having been stripped off from the body.

In its internal structure this species does not offer many differences from *B. gambiana* or *B. budgetti*, except in the sculpturing of the penial setae. The *gizzards*, however, seem to me to be in vi. and vii. instead of v. and vi. The *calciferous glands* are in xiv., xv., and xvi., and, as in other species, the first pair are smaller and of a smoother contour than those which follow. The large *sperm-sacs* are in xi. and xii. There are two pairs of funnels. The *spermiducal glands* are decidedly larger and more coiled than in *B. gambiana*. The *penial setae* are of quite a different pattern, as may be seen from a comparison of the drawings (text-figs. 16-19, pp. 205-214) exhibited. In the present species, as in the last, each sac contains two setae which are curved in form. They are nearly twice the size of those of *B. gambiana* and measure 2 mm. The end is not much hooked and ends in a rather blunt termination. A large part of the distal portion of these setae is beset with

Text-fig. 19.

Penial seta of *Benhamia michaelsoni* (highly magnified).

numerous fine spinelets which are four or five rows in the optical diameter of the seta. The arrangement, however, is not a regular one. These spinelets are precisely those of *B. gambiana*, but a much larger part of the seta is beset with them.

The *spermathecae*, again, are very like those of the last species. The specimen being, however, in a rather better state of preservation as regards these organs, their form could be more accurately ascertained. Each pouch is roughly globular and is nearly sessile upon the body-wall, a short and thick duct putting it into communication with the exterior. There were no visible diverticula.

It will be, I trust, obvious from the foregoing descriptions that the two species with which I am concerned in the present communication are distinct from any of those which have been previously described by myself or others. As, however, the seven West-African species to which I have referred on p. 210 are so extremely like each other and like *B. gambiana* and *B. michaelsoni*, I append a brief series of statements of the chief characters in which they diverge from those treated of in the present paper. I have not been anxious to emphasize the differences which the seven species show from each other, since their distinctness will be generally allowed. The points used serve to discriminate *B. budgetti*, *B. gambiana*, and *B. michaelsoni* from any of those.

- (1) *Benhamia buttikoferi*. A larger and thicker worm. 230–320 mm. by 10 mm. Clitellum xiii.–xix. Last hearts in xiii. Sperm-sacs in xii. only.
- (2) *Benhamia horsti*. Of similar size, but seminal gutter strongly convex outwards. Papillæ more numerous. Penial setæ with fine spinelets arranged in transverse rings and covered by a cap-like structure.
- (3) *Benhamia beddardi*. Of similar size, but seminal gutter convex outwards. Calciferous glands in xv.–xvii. No papillæ. Sexual setæ on vii. and viii. Duct of spermatheca long.
- (4) *Benhamia stampflii*. A larger worm, 330 mm. by diameter of 10 mm. No papillæ.
- (5) *Benhamia schlegeli*. Larger worm, 350–750 mm.; diameter 15 mm. No papillæ. Calciferous glands in xv.–xvii. Last hearts in xiii. Penial setæ “like an elephant’s tusk” in form, 4 mm. long.
- (6) *Benhamia liberiensis*. Larger worm, 350 mm., diameter 10 mm. Papillæ different in arrangement. Calciferous glands in xv.–xvii. Penial setæ dilated at end.
- (7) *Benhamia budgetti*. Of similar size, but genital papillæ different. Penial setæ with few spinelets distally.

The characters of these seven species may be compared with those of the two new species *Benhamia gambiana* and *Benhamia michaelsoni*.

- (1) *Benhamia gambiana*. 170 mm. by 5 mm. Clitellum xiii.-xx. Seminal gutters straight. Genital papillæ in pairs, intersegmental xv./xvii., xviii./xx. Calciferous glands in xiv.-xvi. Last hearts in xii. Penial setæ 1.25 mm., with not very many spinelets at end which is scooped out on one side.
- (2) *Benhamia michaelsoni*. 200 mm. by 5 mm. Seminal gutter straight. Genital papillæ unpaired, intersegmental xxi./xxiii. Calciferous glands in xiv.-xvi. Penial setæ with very numerous spinelets covering a large part of seta; end bluntish.

5. On the Second Occurrence of Bechstein's Bat (*Vespertilio bechsteini*) in Great Britain. By J. G. MILLAIS, F.Z.S.

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(Text-figure 20.)

On the 10th of March, 1901, whilst exploring a chalk cave in the neighbourhood of Henley-on-Thames, Mr. Heatley Noble and I captured six Bats. There were 2 Natterer's Bats, 2 Daubenton's Bats, 1 Long-eared Bat, and an unknown stranger, the identity of which we were quite unable to determine.

The peculiar features of this last-named creature differed so materially from every other British Bat, that it was easy to see that it belonged to some rare species of which the written and figured descriptions were inadequate. After carefully examining Mr. Harting's and Mr. Hall's excellent collections of British Bats, I was still in doubt as to my specimen, though I thought, from Bell's description, the animal must be *V. bechsteini*; and it was only after a close examination by Mr. W. De Winton (who kindly took it to the British Museum, consulted with Mr. Oldfield Thomas, and compared it with others there), that all doubt as to its identity was set at rest.

A few words of description of this rare Bat as it appeared in life may be of interest to the student of small mammals. In general appearance this species resembles *V. nattereri*: in colour it is identical, and the tragus and formula of dentition are the same; but, on the other hand, it differs in possessing an entire and simple margin of the interfemoral membrane, and in the fact that the adult animal is of greater size and the ears much larger and quite different in shape. The gape, too, is unusually wide, extending to the base of the ears, and the wings are different in form.

However, by far the most striking feature, and one which even the most superficial observer cannot fail to notice, is the great size and peculiar shape of the ears of *V. bechsteini*. These first bend outwards at an angle of 75 degrees, and then turn upwards to the perpendicular, coming to a rounded point as