

after it is taken out, and the flesh that remains on the bones is scraped off." Many of the bones, he states, were painted red. This amiable Teuton was careful to rifle the cave tomb and carry off a mule-load of the human remains it contained.

It is with regret that I now bring this paper to a close and lay aside my pen, inasmuch as the article goes forward in very incomplete state. I have many notes on the subject which remain to be written up, but have not been able to obtain the assistance of any of the few men of knowledge left to verify and explain such items. They must be forwarded at some future time. "*Kati te tangi; apopo tatou ka tangi ano.*"

We have now at various times and in divers journals ushered the Maori into the world, and noted the quaint rites pertaining to reproduction. We have told of his origin, his religion, his myths and folk-lore. We have described his food-supplies, his amusements, his arts, and superstitions. His woodcraft and war-customs, his mentality and ideality, have been reviewed. We have married him, and watched him in his last hours. We have despatched his soul to the underworld, and cried him farewell to the dim shores of Hawaiki. And I do not think that we can do much more for him. Nothing remains save the *mate-a-one*.

ART. XXVI.—*Additional Notes on the Earthworms of the North Island of New Zealand.*

By W. B. BENHAM, D.Sc., M.A., F.Z.S., Professor of Biology in the University of Otago.

[Read before the Otago Institute, 10th October, 1905.]

Plate XL.

DURING the last twelve months I have received a few additional gatherings of earthworms from the North Island, for which I have to thank my correspondents, Messrs. Elsdon Best, H. Suter, and C. Cooper. No new area has been tapped, though I hope to obtain worms from the southern part of the Island next year. I find amongst them three new species, two of which belong to the genera *Tokea*, and *Rhododrilus*, to which the common native worms of this portion of the colony belong; a third belongs to a genus (*Dinodrilus*) the only other species of which has been obtained from the South Island.

1. *Tokea sapida*, Benham, P.Z.S., 1904 (ii), p. 245.

Of these species I only possessed a single individual at the time I wrote the account of its structure. I am now able to

amplify that account. Seven individuals were received from Mr. Best.

Colour.—Alive it is dark-brown; preserved in formol, purplish-red. Some are marbled with paler streaks and patches towards the hinder end.

Dimensions.—The specimens range from 135 mm. by 6 mm. up to 290 mm. by 9 mm. A medium-sized individual contains 192 segments; the largest, 210 segments.

The *clitellum*, which was not fully developed in the type, covers segments (13) 14–18 (19)—that is, the dorsal surface of either or both the 13th and 19th may be glandular, but the segments are separated by a furrow from the rest of the organ. It completely surrounds the body, except on the ventral surface of segment 18, where a transverse depression surrounded by a ridge extends from chæta *b* to *b*. In the type this ridge has, by contraction of the body, closed over the depression.

There are no other *tubercula pubertatis*.

The *prostates* are larger than in the type, which was not fully mature; they extend back to the 26th segment. The duct is short, narrow, curved, and confined to the 18th segment.

Loc.—Ruatoki; some twenty miles inland, in the County of Whakatane. Mr. Best writes: "The worms were obtained in the foothills, where the soil is principally volcanic—pumice, &c., with a covering of humus, and a few beds of clay."

2. *Tokea maorica*, Benham, P.Z.S., 1904 (ii), p. 252.

Under this title I have confused two species, which are evidently closely allied, but which I believe are distinct. The account and figures of the external features were taken from a small species, which should, I suppose, retain this name; whereas the internal anatomy was studied on a larger species, to which a new name must be given.

I drew attention to the fact that there was a considerable range in size, in contrast to the constant number of segments. But I now find that the smaller ones possess two *tubercula pubertatis*, the larger ones only that in segment 18.

The characters of *T. maorica*, thus amended, are as follows:—

Colour.—Very dark purplish-brown, extending far down the sides of the body and along the whole length.

Dimensions.—25–35 mm. by 2 mm.; or, in soft, ill preserved specimens, 50 mm.

The *choetal* formula is $ab = aa$; $bc = cd > ab$; $dd = 2ab$.

The *clitellum* occupies segments (13) 14–17, complete.

There are two median *tubercula pubertatis*, having the disposition shown in text-figure 80 (*loc. cit.*).

The *spermathecal pores* are in segments 7/8 (not, as is stated

on p. 254, by a slip of the pen, 8/9), about midway between the chætæ *a* and the hinder border of the segment.

Internal Anatomy.—The last heart is in the 12th segment.

The gizzard, in segment 5. There are no œsophageal glands.

The prostates reach into segment 24; the duct is long, narrow, curved in a sigmoid fashion (? due to contraction of the worm), and occupies two segments.

The spermatheca is an ovoid sac, with a duct of about half its diameter and length. The pyriform diverticulum opens into the duct about half-way along its course.

Loc.—Auckland: Nikau Palm Bush; Waitakerei (*H. Suter*); also "from the sheaths of nikau and *Astelia* leaves, Auckland" (*C. Cooper*).

3. *Tokea decipiens*, n. sp.

This name I propose for larger, paler, brown worms with only a single tuberculum pubertatis, of which I have some half-dozen specimens.

Dimensions.—55–75 mm. by 2 mm., with 75–90 segments.

The *chaetal* formula is apparently $ab < bc < cd$; $aa = bc$; $dd = 3ab$. I write "apparently," for the body-wall is soft and therefore extensible, and the measurements made on different individuals do not give precisely the same figures.

The *clitellum* covers segments (13) 14–17 (18)—that is, in one or two individuals the dorsal surface of part of the 13th and 18th segments are glandular.

The *genital pores* as in the previous species, but there is only a single tuberculum pubertatis, on the 18th segment; none of these larger worms present any trace of one on the 14th segment.

The *spermathecal pores*, near the hinder margins of segments 7/8, behind the chætæ *a*.

Internal anatomy as described in *loc. cit.*

Loc.—Waitakerei Bush, near Auckland (*H. Suter*).

4. *Rhododrilus besti*, Benham, P.Z.S., 1904 (ii), p. 235.

The specimen from which this account was written was the sole individual in my possession at the time; since then I have received half a dozen worms that fit closely with that account.

Colour.—Mr. Best writes: "Light-coloured worms with reddish band [*i.e.*, clitellum] near head." When preserved the worms are white and the clitellum is yellow-brown to reddish-brown.

Dimensions.—They range in size from 110 mm. by 4 mm. to 220 mm. by 5 mm.; the former with 182, the latter with 226, segments.

The *chaetal* formula is $ab = cd < bc$; $aa = bc = 1\frac{1}{2}ab$; $dd =$ about $3ab$.

The *clitellum* is usually on segments 14–17, though occasionally half 13 and half 18 may be glandular.

The *tubercula pubertatis* are not always so numerous as in the type: thus, in addition to a pregenital pair on segment 12 (or, as in type, on segment 11), I find three individuals with pairs on the hinder margin of segments 20, 21; two with them on 20, 21, and 22; one with them on 20, 21, 22, and 23; one with only a single pair on 20; while the type has them on segments 19, 20, 21, and 22. It is well known that these tubercles are somewhat variable, and it is not quite certain that degree of maturity is necessarily correlated with the number of tubercles, for in two of the above instances three or four pairs are present in worms in which the clitellum is not at its maximum of development.

I felt inclined to differentiate these new individuals from the type owing to the difference in the position of the pregenital tubercles, but I can detect no other important distinction.

Loc.—Ruatoki (*E. Best*).

5. *Rhododrilus similis*, n. sp.

In general appearance this worm might readily be mistaken, at least in the preserved condition, for *R. besti*, from which, however, it presents certain well-marked differences. I received about twenty specimens.

Colour.—White, with pale yellow-brown clitellum.

Dimensions.—Mature worms measure from 140–165 mm: by 5 mm, with about 200 segments, which, with the exception of the first six or seven, are annulated, whereas in *R. besti* the annulation commences on the 5th segment.

Chætæ.—In the midbody $ab = bc = cd$, approximately (but just behind the clitellum bc is about $2ab$); $aa > bc$; and $dd = 6ab$.

As is usual in the genus, the two chætæ a, b begin to approach one another at about the 25th segment, so that in the region of the male pores the couple are quite close together, but they separate again anteriorly.

The *clitellum*, (half 13) 14–17, is complete only across 14.

Genital Pores, &c.—The male pores, in line with ab , are on slight papillæ.

The *tubercula pubertatis* have rather an unusual appearance: each is a transverse group or series of glands, visible under a dissecting-lens as a series of translucent dots set on a slightly raised ridge. These tubercula are in the following groups:—

(1.) A pair on the intersegmental furrow 10/11, in line with ab .

(2.) Two transverse series, 14/15, 15/16, extending from the line *a* to *a*.

(3) Two to four post-clitellar transverse intersegmental series, 19/20, 20/21, 21/22, 22/23.

Of these the most anterior extends from *b-b*, the last from *a-a*.

Of the seven mature individuals examined, one specimen alone had four post-clitellar tubercles, three had three, and three had only two tubercles.

There is a single pair of *spermathecal pores* nearly in line *b*, between segments 8/9.

Internal Anatomy.—The last heart is in segment 12.

The gizzard is in segment 5. The intestine commences in the 16th. There are no cesophageal glands.

The sperm-sacs are, as usual, in segments 11/12.

The prostates extend along the sides of the body to segment 21 or 22, being sharply undulating in the last two segments. The duct is very narrow, quite short and straight.

The penial chætæ (and the sacs containing them) are very short, and confined to the 17th segment. The chætæ measure only 2 mm., which is a great contrast to the length of 6 mm. attained by them in *R. besti*. Each chæta is simply curved, ending in an apparently flexible recurved tip. The shaft for some distance below the tip is "ornamented" in a very characteristic fashion; under a low power it appears serrated along each edge, but under a higher power it is seen to be pitted all round. The pits are oblique, with openings distally directed, leaving distally directed proximal edges.

The spermatheca, in segment 9, consists of a short ovoid sac lying on the outer side, and a long cylindrical portion, curved in a semicircle, towards the median line.

Loc.—Ruatoki (*E. Best*).

6. *Dinodrilus suteri*, n. sp.

Of this interesting worm three individuals were sent to me by Mr. Suter.

Colour.—Uniform dark purplish-brown (in alcohol).

Dimensions.—The largest is 40 mm. by 2 mm., with 110 segments.

The *prostomium* is half epilobic, without a transverse furrow.

Chætæ.—The peculiarity of this genus is, of course, the possession of twelve chætæ in each segment; these are almost equidistant, and their arrangement differs slightly from that given for *D. benhami*: $bc = cd = de = ef$; $ab < bc < aa$; $aa = 1\frac{1}{2}ab$; $ef = 2ab$.

Clitellum.—Unfortunately the worms are immature, and

present no trace of a clitellum, but the ventral surface of segments 17-19 is rather paler than elsewhere.

Spermathecal Pores.—Two pairs, 7/8, 8/9.

Dorsal pores commence at 10/11.

Internal Anatomy.—The dorsal vessel is double, uniting at the septa. They are not enclosed in a common perivascular tube such as Beddard described for *D. benhami*.

The last heart is in segment 13.

There is a small gizzard in segment 5. Oesophageal glands are in 16/17, and the intestine begins in the 18th segment.

There is but a single pair of testes visible in sections, and these lie in segment 10; but in addition to the sperm-funnels in this segment there is a second and very minute pair in the 11th segment, rather larger than a nephridial funnel. It is possible that the absence of the testes in this segment is due to immaturity.

No sperm-sacs are developed.

The two pairs of prostates are, of course, quite small, in segments 17/19.

The two pairs of spermathecae are in segments 8/9. Each is a subspherical sac, with a small pyriform diverticulum opening into the duct, close to the body-wall.

Loc.—Swanson, about fifteen miles from Auckland, in rotten logs.

Remarks.—The only previous record of this genus is the account given by Beddard,* in 1888, of *D. benhami*, which was obtained near Lake Brunner, in Westland. This new species differs from it in its much smaller size, in position of the gizzard, the absence of the second pairs of testes, and form of the spermathecae.

EXPLANATION OF PLATE XL

The illustrations of the external anatomy of the earthworms described in this article are purely diagrammatic, indicating only the segmental position of the various organs, the worm being supposed to be slit up along the dorsal line and the body-wall pinned aside.

The location of the various genital pores is represented as round black dots (if on a papilla this is left white), the clitellum is obliquely shaded, the tubercula pubertatis are vertically shaded.

In addition, the arrangement of the chaetae—labelled *a*, *b*, *c*, *d*—is indicated in segments 5 to 23 on one side; they are omitted on the other side for clearness' sake. The true relative spacing of the chaetae is shown.

No attempt is made to give the relative sizes of the worms or of the various organs.

* Quart. Journ. Micr. Sci., xxix, p. 105.

- Fig. 1. *Tokea maorica*.
 Fig. 2. *Tokea decipiens*.
 Fig. 3. *Rhododrilus similis*.
 Fig. 4. *Rhododrilus similis*. Ventral view of the segments 19-21, showing the character of the tubercula pubertatis as seen under a dissecting-lens.
 Fig. 5. *Rh. similis*. The end of a penial chaeta; $\times 480$.
 Fig. 6. The same, much enlarged, showing the pittings on the surface.
 Fig. 7. *Rh. similis*. A spermatheca. *d*, diverticulum.
 Fig. 8. *Tokea maorica*. Spermatheca.
 Fig. 9. *T. maorica*. Proximal end of the prostate, showing relative size of the duct.
 Fig. 10. *Dinodrilus suteri*. A spermatheca.

ART. XXVII.—On a Large Pterotracheid from the Pacific Ocean.

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 Biology in the University of Otago.

[Read before the Otago Institute, 10th October, 1905.]

Plate XLIII.

HITHERTO only a single species of the pelagic group of Gastropods, the *Heteropoda*, has been recorded from the seas that wash our coasts. This is *Carinaria australis*,* Q. and G., which was obtained in 1827, during the voyage of the "Astrolabe," between Australia and New Zealand. We may now add *Firola* (*Pterotrachea*) *coronata*, Forskål, to our marine fauna.

The specimen upon which this identification rests was washed ashore during January, 1905, at Long Beach, a few miles north of the Otago Harbour. Luckily for zoology, it was observed lying on the sandy shore and secured by Mr. W. Fels, of Dunedin, who transmitted it to me at the Museum. Unfortunately, it had been somewhat damaged by the tossing of the surf and by rolling on the sandy beach; thus the epidermis and underlying tissue was in great part rubbed off. The posterior end (metapodium) had been broken away behind the visceral hump. The visceral mass itself was a good deal damaged—only three or four gill-filaments remained of the gill—and part of the male copulatory organ was broken away. The ventral fin (or mesopodium) is also a good deal damaged, at least half of it being absent; but I believe that so much as remains suffices to establish the specific identity with *F. coronata*.

An examination of the literature available showed me that the specimen is much larger than the majority of species of *Pterotrachea* (*Firola*), though *P. adamastor*, Lesson, from the

* Quoy and Gaimard, Voy. de l'Astrolabe, vol. ii, p. 394.