

A Yard-long Earthworm, *Notoscolex hakeaphilus*

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IN July, 1946, I received a particularly long earthworm from Kerikeri, in the Bay of Islands, on the north-east coast of the North Island. It had been found by Mr. S. A. Goldingham "a few inches below the surface near a hedge of an Australian shrub, *Hakea*." When it reached me it was still alive, though very sluggish. Laid on the table, it did not move, though it responded to handling by a weak wriggle. It measured 650 mm. (2 ft. 6 in.) and its diameter was 12 mm. at about the middle of the body.

This is a large size for New Zealand earthworms, though I described some years ago a species of *Diporochoaeta* from the Little Barrier Island which reached a length of 990 mm., i.e., 3 ft. 4 in. (*D. gigantea* Benham, *Trans. N.Z. Inst.*, vol. 38, 1905), but in Australia there is a *Megascolides* which exceeds even this, being 6 ft. or occasionally 7 ft.

Its colour was reddish-brown in the anterior region, becoming paler and ultimately cream-coloured posteriorly. A fairly wide band of pigment runs along the dorsal surface in the middle line and this extends to a point about 130 mm. from the anal end, after which the body is cream-coloured.

The worm was killed in alcohol, slowly increasing in strength, and when dead, placed in strong alcohol.

External Characteristics. The prostomium is epilobic; its margin is marked by short, longitudinal furrows, as is also the first segment. The preclitellar segments are bi-annulate at first and become quadri-annulate further back. The post-clitellar segments are, as is usually the case, much shorter and not annulate; each being about the length of an annulus of the anterior segments.

The *clitellum* extends from the segments xiii to xviii; it is well defined, pale brown in colour and encircles the body.

The *male pores* are on segment xviii, 75 mm. from the anterior end of the worm. They are in a wide transverse oval pit which occupies the entire ventral surface of the segment. The actual pores are situated on papillae which occupy the lateral corners of the pit. I was unable to detect any other genital pores. (Fig. 2.) The spermathecal pores, however, are situated at the intersegments vii-viii and viii-ix.

The *chaetae* are very small, and have an unusual arrangement, being not only widely separated, but more or less alternate. There are eight to each segment. The most ventral, termed "a," are almost but not quite in a straight line in successive segments. So, too, are the dorsal chaetae "d," though posteriorly they depart from that line. (Fig. 2.)

The chaetae are so small that one had to determine their arrangements by noting the small but distinct papillae on which they are situated. Spencer (1892) commented on the difficulty of detecting

the chaetae in several species of this genus. A study of these was made at a point about 120 mm. behind the male pores, for in the preclitellar and clitellar segments they are unrecognisable owing to the strong contraction of the very thick body wall. One cannot help wondering how such minute bristles can be of much help on locomotion, but no doubt the strong muscular body wall will compensate for this. In the more posterior segments as the hinder end is approached the irregularity of the chaetae is even more marked, for the ventrals (a) have now lost their linear arrangement and are, like the rest, scattered irregularly.

The usual condition of the chaetae is the close coupling such as is familiar in *Lumbricus*, but in several species of *Notoscolex* this coupling is absent, and the chaetae are more or less scattered.

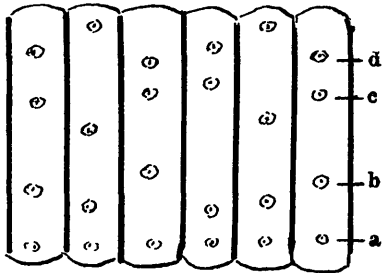


FIG. 1.

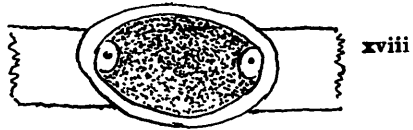


FIG. 2.

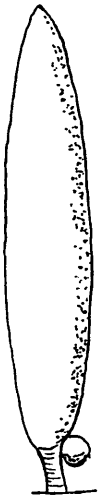


FIG. 3.

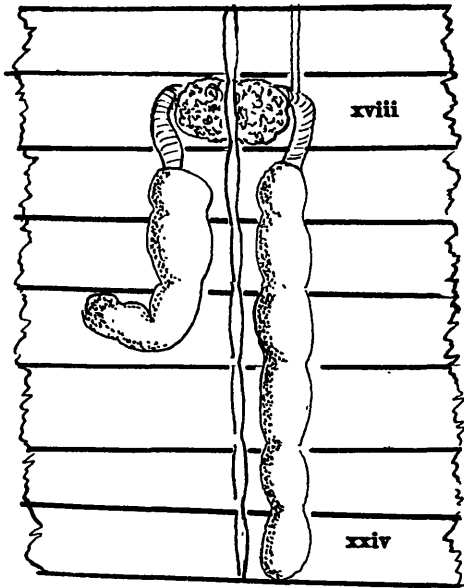


FIG. 4.

FIG. 1—*Notoscolex hakeaphilus*. Side view of six segments to illustrate the arrangement of the chaetae. FIG. 2—The male pores in the shallow pit. FIG. 3—The spermatheca. FIG. 4—The prostates.

Fletcher and Spencer note this divorce of the couples, especially those of the dorsal couple, but I do not find that either these or any other author has referred to the "alternation" such as I described for *N. equestris* (1942) and which is so much more noticeable in the present species.

Internal Anatomy. A very noticeable feature is the great thickness of the anterior septa, especially those forming the hind wall of the segments v, vi, vii, viii, ix and x; that at the hinder wall of xi is moderately thick, but less so, but thicker than those that follow. All these thick septa, especially the more anterior, are infundibuliform, sloping sharply backwards from their origin in the body wall to their attachment to the gut.

Moreover, there are very stout white muscles stretching back from the septum across the following segment to be attached to the floor of the body.

The remarkably thick body wall, these thick septa, and the strands of backward muscles must aid the worm in its activities, especially in burrowing.

The dorsal blood trunk is single and there are three pairs of enlarged lateral hearts in segments viii, ix and x.

The gizzard lies immediately in front of the first thick septum, that is, it occupies segment v, and is preceded by a short, wide "pro-ventriculus" which intervenes between gizzard and pharynx.

In segment viii, the oesophagus, elsewhere thin walled, assumes a thick wall, and forms a sub-spherical enlargement which is presumably an oesophageal gland, though I detected no chalk or secretion, nor is it an "outgrowth" such as occurs in the familiar *Lumbricus*.

The intestine commences in segment xii and for the greater part of its course is thin walled and sacculated, but in the most posterior segments—some twenty or more—it loses this septal constriction and becomes a very wide canal filling the body cavity, and almost reaching the body wall; but it still retains its thin envelope: there is no thick walled "rectum" such as I have described in some other cases.

The worm is micronephric, and in the anterior segments the fine tubules form a great tuft near the nerve cord which might readily be taken for a meganephridium until examined microscopically; together with this tuft there is a multitude of small tubules forming a dense mass ventrally covering the body wall and extending right up to the dorsal region as a mould-like lining to it. But in the posterior segments these micro-tubules are fewer, less widely spread, and in later segments are scarcely visible to the naked eye. There is no meganephridium even in the hinder segments which is sometimes the case with even micronephric worms.

The Reproductive System. There is but a single pair of testes in segment xi, springing from the posterior face of the anterior wall of the segment as usual, and the ciliated rosettes (funnels) project from the hinder wall. Such a condition, where only the posterior testes are present, is termed "metandric."

All the gonads lie close to the body wall at the sides of the ventral nerve cord.

In segment xii is a pair of sperm sacs springing from the posterior face of the anterior septum. The two are in contact for the greater

part of their substance, for they meet above the dorsal blood vessel. In fact, they form an apparently single median mass, compact, granulated, and hiding the intestine.

The two pairs of Spermathecae in segments viii and ix, opening as usual on the anterior margin of these segments, though I was unable to detect the apertures externally.

Each receptacle is a long, simple, cylindrical sac, 8 mm. in length, with a minute globular diverticulum opening into the short duct close to the body wall. (Fig. 3.)

The prostates lie in segments xviii to xxiv, lying on body wall close to the nerve cord. They are flat, somewhat sausage-shaped, with sides slightly incised by the septa of the intervening segments. The duct is short, stout, and straight. As may be seen in the figure (Fig. 4) the prostate of the left side is curved on itself and reached forward to the segment xx.

The ducts pass through a mushroom-shaped gland which forms the roof of the external median pit. The sperm duct, which is embedded in the tissues of the body wall, I exposed and traced to its entrance into the prostate duct close to its exit to the exterior.

The pair of ovaries and their ducts lie in the usual segment.

DISCUSSION.

The first matter to be decided is the genus to which this species should be referred, for there is a very close similarity between the two genera *Notoscolex* and *Megascolides*. So close is this that the question of the union of the two has been discussed *ad nauseam* by the oligochaetologists, Michaelsen, Stephenson and myself. To this I have referred in my articles, 1905, 1941 and 1942 (in the last I give the references) and summarised the views of my colleagues. Here I follow Stephenson, though he admits that the separation of the two genera is "one of convenience" and the only essential difference between them is in the microscopic structure of the prostate. Those in which the prostate has a distinct axial canal giving off branches are allotted to the genus *Megascolides*, whilst those in which such an axial canal is absent and only the branches are present are referred to *Notoscolex*. As the present worm has not an axial canal, I place it in the latter genus.

The "home" of both of them is Australia, though species also occur in India. Since the present worm from Kerikeri was found under the shrub *Hakea*, which is an Australian plant, it has doubtless been accidentally imported from that country.

We may exclude India as its origin, since the only articles imported from that country are wool packs, and it is not likely that cocoons would get into them, whereas in the case of the shrub, they might be contained in the soil round the roots of the *Hakea* in the early days, in the same way as has happened in other instances of "imported" earthworms.

The cocoon contains several embryos—how many is not known for these two genera—but in those instances in which the matter has been studied, some three to six little worms form the contents of a cocoon; these when hatched out in the new environment would soon start a "colony" of worms, and thus the species may become established.

• We must, then, look to Australia, and see what species living there approaches the Kerikeri worm.

- (a) Taking first the size;
- (b) the arrangement of the chaetae;
- (c) the internal structure such as the number of spermathecae, their shape and that of the diverticulum; and
- (d) various other features.

The size as stated usually by authors refers to the length of the preserved worm, and consequently is less than it is in life, but even if the measurement is taken during life, it is not certain whether this is the length when crawling, and therefore at a stretch, or when at rest. For example, the present earthworm was measured alive when at rest and reached 650 millimetres, i.e., 2 ft. 6 in., but according to Mr. Goldingham it was when crawling "about five feet." I confess that I doubt this, for when I measured it after killing it in alcohol and allowing it to soften in water so that it was extended to the utmost, it was only 950 mm., that is, 3 ft. 6 in. That was the extreme length to which in life it could attain, so we must discard, as guessing, the statement of the finder. Therefore, in attempting to compare this animal with any Australian species, we must look for one that measures about 2 to 3 feet, with two pairs of spermathecae, one pair of testes in segment xi.

The only one with these characters occurring in Australia is *N. singularis* Fletcher (1888), but this is only 45 mm. long, so we may leave it out of account.

Having compared all the likely species from Australia, and neglecting as improbable those from India, I must regard the Kerikeri earthworm as a new species.

A species of *Notoscolex* has been recorded as occurring in New Zealand by Schmarda in 1861 under the title of "*Hypogaeon orthostichon*," which he found on Mount Wellington, which is near Auckland. It has been referred to the genus *Megascolides* by Beddard (1892) and to *Notoscolex* by Michaelsen (1916). It is evidently different from the present species in its small size of 80 mm., its dark red colour, and its chaetae have the normal arrangement of being in four couples.

A second species, *N. equestris*, from one of Poor Knights, a group of islands off the coast of the North Island, was described in 1942.

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