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A CONTRIBUTION TO THE BIONOMICS OF ENGLISH OLIGOCHÆTA

PART I. BRITISH EARTHWORMS

By THE REV. HILDERIC FRIEND, F.L.S., F.R.M.S.
110, *Wilmot Road, Swadlincote, Burton-on-Trent.* *April* 10, 1913

Scope of the Inquiry.—The annelids fall into two great orders, which are known respectively as Polychæts and Oligochæts. The former are marine, the latter terrestrial. Polychæts are so named on account of the large number of bristles, chætæ or setæ, which are a characteristic of many of the species; while the Oligochæts are marked by the comparative fewness of the setæ. It is true that some Polychæts have few setæ, and some Oligochæts have many, but that simply shows that Nature is not bound by human laws, or that no system of classification is perfect. It is not proposed in this paper to inquire into the bionomics of the Polychæts, the other great order being more than sufficient for our present study. The Oligochæts fall into various groups, and each is worthy our most careful investigation. But in order that we may gain an accurate knowledge of our subject it is necessary to restrict ourselves to those species which are indigenous; and as these again are arranged in different families, each of which has its own peculiarities, the inquiry will in the present instance be limited to the largest forms of terrestrial annelids found in Great Britain. These are popularly known as Earthworms, and thus we are reminded of that interesting and instructive volume by Darwin entitled *Vegetable Mould and Earthworms.*

In spite of the splendid lead which that volume gave to a subject of supreme importance, it is surprising how indifferent the public has remained to the life-history and economics of this class of animals. Many thousand copies of the work were sold, and doubtless hundreds of readers opened their eyes in amazement as they read. Then the book was closed, and the eyes as well, never to be reopened except in the case of one

or two enthusiasts, who have quietly carried on the work during the intervening quarter of a century, with very amazing results. The time has now come when it is possible once more to survey the subject, and create a new point of departure.

The Number of Species.—As our inquiry is limited to the British Lumbricidæ, the question naturally arises, How many species of Earthworm are there in the British Isles? It will be instructive, in answer to that query, to look a little into the history of the subject. In 1865 Dr. G. Johnston compiled *A Catalogue of British Worms*, based on the collection then found in the British Museum. The number of Lumbricidæ there recorded is eleven, about half of which are satisfactory, while the remainder are doubtful. Under one or two headings we find more than one species confused, while in other cases the same species appears under more than one name.

Darwin does not allude to Johnston's catalogue. He remarks that "The British species of Lumbricus have never been carefully monographed; but we may judge of their probable number from those inhabiting neighbouring countries. In Scandinavia there are eight species, according to Eisen; but two of these rarely burrow in the ground, and one inhabits very wet places or even lives under the water. Hoffmeister says that the species in Germany are not well known, but gives the same number as Eisen, together with some strongly marked varieties."

When Dr. Rosa published his *Revisione dei Lumbricidi* in 1893 he enumerated six species of Lumbricus, forty-nine of Allolobophora, and six of Allurus. Thus the number of European Lumbricidæ had been raised to upwards of sixty species. Beddard two years later issued his *Monograph of the Order Oligochæta* (1895), and allowed three species of Allurus with Tetragonurus, fifty-two of Allolobophora, and seven of Lumbricus known to science. The following year (1896) de Ribaucourt's *Étude sur la Faune Lombricide de la Suisse* appeared, and no fewer than forty-four species of Allolobophora were recorded for Switzerland alone, in addition to seven species of Lumbricus and five of Allurus. Passing over the work of Vaillant, Oerley, and others, we arrive at the year 1900, which marked the appearance of Michaelsen's volume on *Oligochæta* (*Das Tierreich*, x.), in which the number of species has grown beyond all bounds.

My own researches commenced in 1890, and it was then assumed that our native Earthworms numbered half a score,

or at most a dozen species. To-day the figure stands at forty and upwards, and there are doubtless still several discoveries to be made in our gardens, islands, and mountains. It is with these forty species that we are immediately concerned.

Rarity and Frequency.—It must not be assumed that they are all generally distributed over the British Isles. In a few instances the species is represented by a solitary specimen, and in others, while the number of specimens is unlimited, they are at present known in only one locality. While many are common throughout the country, as well as in Europe, others have a range which is very instructive. Let us take a few examples. In 1892 I wrote to Dr. Rosa of Turin to the effect that a new worm (*Lumbricus papillosus* Friend) had turned up in Ireland. He alludes to it in an appendix to the genus Lumbricus (*op. cit.* 27), and notes incidentally that the name had already been appropriated by O. F. Müller. On this account Cognetti afterwards changed it to *Lumbricus friendi.* This species has been sought unceasingly in every part of England, Scotland, and Wales without a trace being found, yet I no sooner landed in Dublin in March last and began my researches than it turned up in plenty. In 1890 Michaelsen placed it in his list of species, and recorded it for Switzerland, while Southern has more recently remarked that "*L. friendi* is common in the south of Ireland. On the Continent it is markedly alpine in its range, and is only found at considerable elevations in the Pyrenees and the Alps." In the light of Taylor's recent paper on "Dominancy in Nature" this is most instructive.

We may compare with this the distribution of another of our British Lumbricidæ, which, so far as I am aware, has never been studied by any other investigator but myself. In 1910 I was spending Easter at Bridlington, and found a solitary specimen of *Octolasium gracile* Oerley. It was new to Britain, and would seem to be gradually working towards the west. Up till the present it has never been found in Ireland, Wales, or the West of England, and in Scotland and the Midlands is very rarely seen. Yet in the autumn of 1911 it was the dominant Lumbricid at Sutton Broad in East Anglia, and in Epping Forest and elsewhere in the south and east it is quite gregarious. Unfortunately Michaelsen confuses it with *O. lacteum*, from which, in England at least, it is absolutely distinct; and

thus we are unable at present to give its Continental distribution with certainty. Oerley found it near Budapest and Vlissingen. He also found it, or a variety, alike in Hungary and at Woolwich. I cannot distinguish the Epping Forest forms from that named *O. rubidum* Oerley. Mons. de Ribaucourt regarded *O. gracile* as a subspecies of *O. profugum*, and records it as such for Switzerland. Is it possible that in England it has developed along definite lines, and so become a well-marked species, while in Europe its affinities with *O. lacteum* Oerley (= *O. profugum* Rosa) are still clearly marked ?

Some curious facts relate to the genus Allurus. It was recorded as British by Johnston, and rediscovered about 1890 in Dorsetshire and Devonshire. The type (*A. tetrædrus*) is now known to be one of our commonest worms. It occurs in every part of the British Isles by streams, water-courses, ditches, ponds, and water generally. The type, moreover, is very constant in this country. I have found one or two varieties in different parts of England, but they have been marked chiefly by variations in colour (as var. *luteus*, etc.). But a study of monographs will reveal the fact that Allurus is not a simple species, and when the subject has been more carefully studied its lessons will be very instructive. On the one hand we find that a number of pigmy species are found in the Swiss Alps, while *A. hercynius* Mich. has once been found in Scotland, *A. tetragonurus* Friend at Bangor in Wales, and *A. macrurus* Friend at Malahide, near Dublin. Following out these hints, we conclude that *A. tetrædrus* is dominant, and that the allies have been forced into outlying districts, where a careful search would probably be rewarded by the discovery of other interesting forms. If the West of England, Wales, and Scotland were explored with care it might be possible to gain much light on some of the problems which such facts as these suggest.

Again we have one record only for an alpine species of Lumbricid (*Eisenia alpina* Rosa), although we certainly ought to find others in the highlands of Scotland if not in other localities. I shall have occasion under another heading to speak of certain garden worms found in various parts of the country, but it will be well to observe here that one worm (*Octolasium intermedium* Friend) has hitherto been found in Oxford Botanic Gardens only, *Dendrobæna merciensis* Friend only in leaf mould in Derbyshire, *Helodrilus elongatus* Friend (a species which has not yet been

described) in a garden in Cornwall, to say nothing of certain more or less well-known species which occur in Kew Gardens. During the spring of the present year *Allolobophora antipæ* Mich. was found by me at Blenheim Palace, *A. norvegica* Eisen and possibly other species new to Britain being discovered about the same time in Dublin. All these have a bionomic value which is unique, and suggest the need of a much more systematic examination than has ever yet been undertaken.

Having referred in the foregoing section to those species which are of rare occurrence or limited range, it may be well to add that a certain number of species are everywhere to be met with. *Lumbricus terrestris* L. and *Allolobophora longa* Ude are the dominant types. *L. rubellus* Hoff. and *L. castaneus* Savigny abound in meadows; *L. festivus* Sav. being less common. *A. chlorotica* is always to be found in damp places, under stones, and near the haunts of cattle, where *A. caliginosa* (which includes *turgida* and *trapezoides*) is also frequently discovered. The brandling and gilt-tail, to be mentioned again later, are ubiquitous, the curious tree worms are fairly common in old tree trunks, and in road scrapings one is pretty sure to meet with *D. mammalis*. In gardens and fields one finds two species of Octolasium pretty generally distributed, and *E. rosea* is another of the widely known species. Having just completed a report on the distribution of earthworms in England I may refer the interested reader to the pages of the *Zoologist* for further details.

Habits and Habitats.—We may naturally pass on to a little fuller study of some details in the life-history of our indigenous earthworms. Is it possible to tell where certain species may be found? Can one judge by the locality what species are likely to occur? The answer is in the affirmative. Thus if one sees a decaying tree trunk in a moist condition he may be pretty certain that he will not look in vain for such species as *D. arborea*, *D. subrubicunda*, *L. castaneus*, *B. eiseni*, and somewhat rarely *D. octædra*. Several of these also occur in leaf mould, along with *D. merciensis*, *L. rubellus*, and *Eisenia rosea*, *veneta* or *fœtida*. The latter (*E. fœtida* Sav.), which is popularly known as the Brandling, is the first to attach itself to stable manure. It will thrive in such material long before any other species can find a subsistence in the strong pungent mass. When decomposition has set in, however, *L. terrestris*, *L. rubellus*, and *D. subrubicunda* will become common, along with large quantities of *Enchytræus*

albidus Henle. Later still one finds *A. chlorotica*, *A. caliginosa*, *E. rosea* and other forms. Ditches are frequented by *Allurus tetrædrus*, *A. chlorotica*, *D. subrubicunda*, *D. merciensis* and *O. gracile*. And here it may be remarked that the other species of Octolasium found in England rarely occur in such situations, but prefer gardens and ploughed fields. Another difference will be indicated hereafter.

In many parts of the country it is the custom for the roadmen to place their sweepings and scrapings in heaps either by the roadside or in a field or waste plot. For a time no signs of life will be found here; then various Fridericias and other Enchytræids begin to abound, and with these one will nearly always find such earthworms as *B. eiseni*, *B. constrictus*, *L. castaneus*, *E. rosea*, and *D. mammalis*. If a fork is inserted in the soil of pastures and worked to and fro, *L. castaneus*, *L. rubellus*, and *L. festivus* may readily be obtained. In some places the same means will be successful in bringing out *A. longa*, *A. caliginosa*, *E. rosea*, and one or two others. It thus appears that a certain number of species have well-defined habitats and definite habits, such forms as Allurus never being taken save where moisture is found, and the Octolasiums being found either in ditches (*O. gracile*) or in gardens and fields. Nearly all our native species love moisture, but they frequently perish in great numbers in times of continued flood.

Slime and Mucus.—One has not to study the Lumbricidæ long before becoming aware of great differences in relation to the matter which is given off under irritation. All our earthworms are provided with dorsal pores, and from these we frequently find an exudation of one kind or another. In the case of the different species of Lumbricus there is a watery discharge quite distinct from the slime which is one of their chief characteristics. This fluid is best seen when the worms are partially dried. They seem then to pour it out from the dorsal region with a view to moistening their surroundings and thus making progress possible. It must be observed that the native Lumbrici (of which we have four species in England, and a fifth in Ireland) never give off a coloured or fœtid liquid. In this respect Allurus, *B. eiseni*, *A. longa* and one or two other Allolobophoras are in agreement with the Lumbrici. With reference to the Allolobophoras (including therein Allolobophora, Octolasium, Aporrectodea, Dendrobæna and other genera) there is a great deal of diversity

in the matter of secretion. Some exude it from the entire length of the body, others from the head or tail, or from special segments. Nor is the appearance and smell the same in the different cases. Let us examine a few of the principal.

In the Brandling (*Eisenia fœtida* Sav.) we find a very profuse exudation of a yellow colour and pungent odour from almost the entire length of the body. To some the smell resembles garlic, to others the liquor from boiled cabbage. It leaves a good deal of powdery matter behind when dry, but I am not able to recall any memoir dealing with its chemical constituents. Next to it, so far as volume of output goes, we may place *A. chlorotica* Sav., often known as the green worm. It is very sluggish as a rule, and one would suppose the secretion serves to keep off enemies. It is similar in colour to the last, and may be poured off from any part of the body. *Eisenia rosea* Sav. and *Eophila icterica* Mich. also act in a similar way, but the fluid, particularly in the case of the former (which was once known as *Allo. mucosa*), leaves a white chalky sediment. *D. subrubicunda* has a yellowish tail, and it frequently happens that a large quantity of gold-coloured secretion exudes therefrom. Then from *O. cyaneum* and *O. profugum* a yellow exudation may be obtained from the region of the sexual organs and from the caudal segments. Thus, without giving further details, it is very clear that much variety prevails, and it seems very desirable that a careful study of the subject should be undertaken with a view to determining the exact nature and composition of the various kinds of fluid, and the exact purposes for which the fluid exists. The slime seems to be almost purely lubricative, the white and yellow fluids preservative.

Helodrilus oculatus Hoffmeister.—As illustrating some of the problems in bionomics which the study of the Oligochæts raises, it may be well to take one particular species; and I select for the purpose *H. oculatus*. The name is well chosen. Helodrilus means the worm found by low marshy ground (ἕλος) on the sides of rivers, while *oculatus* refers to the presence at certain periods of a couple of eye-spots. This is, I believe, the only species of Lumbricidæ in which eye-spots have been discovered, and is of interest because such spots are not unknown in Naididæ on the one hand and Polychæta on the other. Helodrilus was first described by Hoffmeister in 1843. No adult was known, and the description was therefore incomplete;

and for many years it was lost to sight. It was rediscovered in 1890, but as the connection was not then recognised Michaelsen named it *Allolobophora hermanni*. In 1896 de Ribaucourt gave a full description of it as found by him in company with *Lumbricus michaelseni* in extremely humid soil. He remarks that by its form and manner of life it appears to be a link between the terricolous and the limicolous species. But as yet the connection between the two had not been suspected. Rosa, in 1893, had given Michaelsen's *A. hermanni* place in his *Revisione*, but does not allude to Helodrilus, and in 1895 Beddard has the following note: "*H. oculatus* Hoffm.: This is an extremely mysterious species, neglected by Rosa in his recent revision of the Lumbricidæ, and therefore probably not believed by him to be a Lumbricid. Its most remarkable structural peculiarity is a pair of eye-spots on the buccal segment. There are four pairs of setæ in each segment, which are straight instead of curved, and said to be black; the male pores are upon the fifteenth segment. The body is elongate and pink in colour; the length at most 135 mm. It occurs on the seashore in pools more or less dried up." Beddard adds that "Vaillant suggests that this worm is probably a Tubificid, on account of the presence of eye-spots, and because of its habitat. The black setæ are very suggestive of what I have myself observed in *Tubifex rivulorum*. But it does not seem to me that we are justified in relegating the genus to any family at present."

When, in 1900, *Das Tierreich: Oligochæta* appeared, Michaelsen put the matter right. He showed that *H. oculatus* Hoffm. and *Allolobophora hermanni* were one and the same, and gave Germany, Switzerland, and Italy as its distribution. In the course of time England was added to the list of habitats. As I was exploring the pond in the Cambridge Botanic Garden in July 1907, I found several adult specimens of the worm, and sent an account of it to the *Gardeners' Chronicle* some time later. Next it was found by Mr. Evans near Edinburgh, and at the same time I found the immature forms at Malvern, with the eye-spots distinctly visible. But though I kept it under observation for two years, I was never able to find an adult. During the past three years I have taken *H. oculatus* from mud on the banks of the Thames at Kew, near the sea at Hastings, by the dykes in Pevensey Marsh, by streams and ditches in Derbyshire

and Notts, by the Dodder at Ballsbridge, Dublin, and by the stream at Swords; and have received it from Epping Forest. The forms at Kew were large, with correspondingly large cocoons, while those at Malvern were small with small cocoons. It is in many ways a most curious worm, and seems, like *O. gracile*, to be gradually working westward.

Constancy and Variation.—This reference to the two forms of *H. oculatus* Hoffm. leads me naturally to some remarks on the tendency to change in some worms, and the evidences of stability in others. The most stable English worms are the four species of Lumbricus and the three species of Octolasium. Out of the thousands of specimens which I have examined during the past quarter of a century, it has rarely been my lot to see any varieties of either. Some years ago I recorded a short-tailed form of Lumbricus for Calverley near Leeds, and some Continental writers affirm that the girdle of *L. terrestris* extends over more than six segments, but I have never seen a single case of this kind in England.

It might here be remarked that normally the girdle in the genus Lumbricus extends over six segments, while the tubercula pubertatis occur as a band on the innermost four. Further, there is a regular gradation in the matter which is peculiarly interesting. This may be shown by the following chart, in which the figures show the segments covered by the tubercula:

1. L. rubellus Hoffm.	28,	29,	30,	31.				
2. L. castaneus Sav.		29,	30,	31,	32.			
3. L. melibœus Rosa			30,	31,	32,	33.		
4. L. tyrtæus?				31,	32,	33,	34.	
5. L. studeri de R.					32,	33,	34,	35.
6. L. terrestris L.						33,	34,	35, 36.
7. L. papillosus Friend							34,	35, 36, 37.
8. L. festivus Sav. (= rubescens Friend)								35, 36, 37, 38.

No. 4 is doubtful, but in view of the regularity here displayed it seems impossible to believe that there is not a true form to fit the niche. But while the tubercula are constant it is curious to observe that the girdle is variable in one or two instances, and these become instructive accordingly. Why is it, for example, that the Irish worm *L. papillosus* has only five girdle segments instead of six, and has a pair of large papillæ on each side? *L. melibœus* similarly has only five girdle segments.

The three species of Octolasium found in England are like

the Lumbrici in this respect: they each have six girdle segments; but while two of them have the tubercula extending over the four innermost girdle segments, the third (*O. gracile*) has the band along the whole six. Along with this peculiarity we have also a difference of colour, habit, and habitat. *Octolasium gracile* Oerley is somewhat flesh-coloured, emits no turbid fluid, and is found in wet places; while *O. cyaneum* and *O. lacteum* have steel-blue bodies, clay-coloured girdles, and yellow tails, from which coloured fluid exudes, and are found in gardens and fields, chiefly in ground which is under cultivation.

Among the Allolobophoras the most constant seems to be *A. longa*, which shares with *L. terrestris* the dominancy among British Earthworms. The two are readily distinguishable by the position of the girdle, the colour, and the shape of the prostomium, but were until quite recently constantly mistaken the one for the other. In the case of almost all the other species of Allolobophora variation constantly occurs. Thus *A. caliginosa* has two forms, which are sometimes so well marked that they might pass for different species; hence the name *turgida* applied to one, and that of *trapezoides* to the other. The green worm is exceedingly variable. Sometimes it is an intense green and very sluggish, so that it might be mistaken for a grub. At other times (*forma cambrica* Friend) it is just as active, and has a colour resembling that of *caliginosa*. The mucous worm (*Eisenia rosea* = *mucosa*) has well-marked varieties, one of which (*macedonica*) occurs in England and on the Continent, and might almost pass for a subspecies at times. So among the Dendrobenes we have *subrubicunda* and *arborea*, which have similar peculiarities to those found in the foregoing species; and while at times they are perfectly distinct, at other times it is impossible for an expert to say whether a given specimen is truly one or the other. If any one wishes to pursue this subject further he will find that Michaelsen, Rosa, Beddard, Eisen, Cognetti, De Ribaucourt, Vejdovsky, and others abound in illustrations and supply abundant material for the most critical biologist.

Allusion was made above to the genus Allurus, and a further reference may be permitted under this heading. In July of last year (1912), while I was collecting at Hastings, I had the good fortune to find quite a number of Oligochæts which were either

new to science or to Britain. Among these was a fragile creature flourishing in alga at Ecclesbourne, near where the little stream falls into the sea. About a dozen specimens were collected and taken home for examination. These, however, perished almost immediately, before I was able to prepare a description. It was necessary, therefore, to get a fresh supply if possible, and preserve them forthwith. This was done, and notes were taken both of the living and the preserved forms. In no case was an adult specimen to be found, and for the present one is obliged to speak cautiously; but the evidence clearly pointed to a new species of British Oligochæta, and the creature has been named provisionally *Allurus mollis*. Just as the dominant type has driven some species to the Alps and others to the borderlands of Wales and Ireland, so it is possible that in this case a tender form has been compelled to find refuge in algæ, to take to the boats indeed, just as the Tanka people on the Chinese rivers have done in escaping from the oncoming Celestials of more robust and over-mastering character.

As a final illustration of the extent to which variation may run (without alluding to internal structure and the work of Woodward, Bateson, and others), one may take that most polymorphic of all Allolobophoras, *Eisenia veneta* Rosa. Its history is one of great interest, and may be read in the pages of Rosa and in my own contributions to annelid study. I first found it many years ago in Dr. Scharff's garden, Dublin, and named it *A. hibernica*, not knowing that it had also been found in Venice. In March of this year I found it again in Dublin, in a neighbouring locality. After the lapse of some years a second British form turned up at Oxford, which I named *Tepidaria*. This has not yet been found elsewhere, so far as I am aware; but it is a striking variety. I failed to obtain it again during a recent visit to the Oxford Botanic Garden. In 1909, while collecting in some gardens at Malvern, I came across two new forms, one of which was very robust (*E. robusta* Friend), while the other was like a dendrobene (*E. dendroida* Friend). A variety found in Cornwall has not yet been named, but Southern has taken a further form in Ireland which is similar to Michaelsen's variety *zebra*, and yet another variety is named *hortensis*. It is such facts as these which make the study of our Earthworms full of interest to the biologist. They are but samples of the kind of material which an extended investigation has enabled one to

bring together; and the examination of our Enchytræids and other Oligochæts supplies us with further material of an equally instructive character.

List of British Earthworms.—At last the Lumbricidæ of Great Britain have been fairly well investigated, and the reproach that they "have never been carefully monographed" may be wiped away. Southern and I have done our best to make the list complete, and although we shall probably be able in time to make a few further additions, when the gardens connected with our old mansions have been explored, and the highlands and islands have been investigated, yet we cannot hope to find many new species. The following list will be of service for future workers, and supplies sufficient information for working purposes.

ALLURUS (Eisen) = EISENIELLA (Michaelsen)

1. A. tetrædrus Sav. Dominant. Very widely distributed.
   Var. luteus Friend. Carlisle, Calverley, Newark, and elsewhere.
2. A. tetragonurus Friend. Bangor in Wales.
3. A. macrurus Friend. Malahide, near Dublin.
4. A. hercynius Michaelsen. Scotland.
5. A. mollis Friend. Hastings and Burton Joyce.

EISENIA (Malm. em. Michaelsen)

6. E. fœtida Savigny. Everywhere in manure and rich soil.
7. E. veneta Rosa. Represented by the varieties named.
   Var. hibernica Friend. Dublin.
   Var. tepidaria Friend. Oxford Botanic Garden.
   Var. robusta Friend. Gardens at Malvern.
   Var. dendroida Friend. Gardens at Malvern.
   Var. zebra Michaelsen. Ireland.
   Var. unnamed. Gardens in Cornwall.
8. E. alpina Rosa. Perthshire, Scotland.
9. E. rosea Sav. Widely distributed.
   Var. macedonica Rosa. In gardens: Kew, Chelsea.
   Var. unnamed. Cambridge Botanic Garden.

ALLOLOBOPHORA (Eisen em. Rosa)

10. A. georgii Michaelsen. Valencia, Ireland.
11. A. caliginosa Sav. Widely spread. Two forms:
    Var. turgida Eisen. Common.
    Var. trapezoides Dugès. Common.
12. A. longa Ude. Everywhere dominant.
13. A. relictus Southern. Clare Island, Ireland.

Aporrectodea (Oerley)

14. A. chlorotica Sav. Very widely distributed.
    Var. cambrica Friend. Wales, Cambridge.
15. A. similis Friend. Kew Gardens.

Dendrobæna (Eisen em. Rosa)

16. D. rubidus Sav. Under two forms:
    Var. subrubicunda Eisen. Very widely spread.
    Var. arborea Eisen. In decaying tree-trunks.
17. D. mammalis Sav. Frequent in road scrapings, etc.
18. D. merciensis Friend. Derbyshire, England.
19. D. octædra Sav. Local and somewhat rare.
20. D. submontana Vejd. Kew Gardens.

Helodrilus (Hoffm. em. Mich.)

21. H. oculatus Hoffm. Sussex, Surrey, Essex, Notts, Derbyshire; also Dublin and Swords, in Ireland; Scotland.
22. H. ictericus Sav. Kew, Chelsea, Cambridge, etc.
23. H. elongatus Friend. Pencarrow, Cornwall.

Bimastus (Moore)

24. B. beddardi Mich. Ireland.
25. B. eiseni Levinsen. England, Ireland, Wales, Isle of Man, and Scotland.
26. B. constrictus Rosa. Not very common, but somewhat widely distributed.

Octolasium (Oerley em. Rosa)

27. O. cyaneum Sav. In cultivated ground.
28. O. lacteum Oerley (= profugum Rosa). Pretty generally distributed, in cultivated ground.
29. O. gracile Oerley. In ditches and wet places, chiefly in the East of England.
30. O. intermedium Friend. Oxford Botanic Garden.
31. O. rubidum Oerley. Reported by the discoverer as found at Woolwich, but not confirmed hitherto.

Genus not yet Determined

32. Allolobophora antipæ Mich. Blenheim Palace, 1913.
33. Allolobophora norvegica Eisen. Dublin, March 1913.
34. Allolobophora (doubtful). Dublin, March 1913.
35. Allolobophora (doubtful). Dublin, March 1913.

Lumbricus (Linnæus em. Eisen)

36. L. rubellus Hoffm. Universally distributed in Britain.
37. L. castaneus Sav. Similar distribution to last.
38. L. festivus Sav. Less common than the foregoing.
39. L. papillosus Friend (= L. friendi Cognetti). South of Ireland.
40. L. terrestris Linn. Widely distributed.

This list shows a total of forty species, with about a dozen forms and varieties, some of which have been given specific rank by one or other of our leading authorities. I have pleasure in gratefully acknowledging a grant from the Government, through the courtesy of the Royal Society, to enable me to carry out this research into Annelid Bionomics and Economics.

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