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ARTICLE V.

NOTES ON SPECIES OF NORTH AMERICAN OLIGOCHÆTA. V. THE
SYSTEMATIC RELATIONSHIPS OF LUMBRICULUS (THINODRILUS) IN-
CONSTANS (SMITH).

BY

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ERRATA AND ADDENDA.

- Page 55, line 15, for 1854 read 1855.
Page 55, line 16, for *Horticultural* read *State Agricultural*.
Page 60, in second table, Illinois, for 240 read 241.
Page 65, first line above foot-note, for *ventricosa* read *ligamentina*.
Page 72, line 9, for *imbecilis* read *imbecillis*.
Page 79, line 19, for *asperimus* read *asperrimus*.
Page 80, above *Quadrula rubiginosa* insert Section *Fusconaia* Simpson.
Page 76. The record of Calkins for *Margaritana margaritifera* is without doubt erroneous and should be eliminated. This species is not found in Illinois.
Page 95. *Pomatiopsis sheldonii* Pilsbry should read *Ammicola sheldonii* and should be transferred to the genus *Ammicola* on page 93.
Page 100. *Physa gyrina oleacea* Tryon is the immature stage of *Physa gyrina*.
Page 103. *Lymnæa tazewelliana* is a synonym of *Lymnæa parva*.
Page 105. *Lymnæa palustris michiganensis* is the immature form of *Lymnæa reflexa*.
Page 106. *Lymnæa reflexa iowensis* and *Lymnæa reflexa crystalensis* are synonyms of *Lymnæa reflexa*.
Page 112, line 6 from bottom, for *gouldi* read *gouldii*.
Page 114, line 5 from bottom, for *juxtigens* read *juxticens*.
Page 115, line 21, for *Witter* read *Walker*; line 23, *Polygyra sayii* Binney should be changed to *Polygyra sayana* Pilsbry.
Page 116, line 1. *Polygyra exoleta* Binney (1885) should be changed to *Polygyra zaleta* Binney (1837).
Page 117, line 11 from bottom, for *leai* read *leaii*; line 3 from bottom, *Polygyra monodon fraterna* is a good species and should read *Polygyra fraterna*.
Page 119, foot-note. A specimen of *alliaris* in the collection of Mr. Aldrich, received from Calkins, proves to be *draparnaldi*.
Page 121, line 3 from bottom, for *Champaign* read *Piatt*.
Page 122, line 12 from bottom, for *Pyramidula striatella* Anthony read *Pyramidula cronkkiti anthonyi* Pilsbry; line 4, for *Held* read *Hald*.
Page 123, for *Helicodiscus lineatus* Say read *Helicodiscus parallelus* Say.
Page 162, line 7, for *glandulosa* read *linearis*.
Page 171, line 17, for *riparia* read *vulpina*.
Page 176, line 8 from bottom, for *canadense* read *majus*.
Page 180, line 9, for *virginica* read *virginiana*.
Page 221, line 6 from bottom, for *rectangulus* read *rectangularis*.
Page 226, line 3, for *fasciatus* read *fasciata*.
Page 239, line 11, strike out Lake Co. entry.
Page 246, lines 6 and 7, and page 248, lines 1, 14, 20, and 23, for *Ænothera* read *Onagra*.
Page 248, line 4, for *candida* Horn substitute n. sp.

Page 249, line 8 from bottom, for *Olethreutes dimidiana* Sodoff? read *Olethreutes separatana* Kearfott, and strike out parenthetical matter.

Page 251, line 7, for *grossa* read *thoracica*; line 21, for words preceding H. 6, read *Asilus rufipennis* Hine; line 18 from bottom, for words preceding H. 2, substitute *Asilus cacopilogus* Hine.

Page 253, line 8, for *Linn.* read *Emory*.

Page 257, line 15, for *pennsylvanicus* DeG. read *auricomus* Rob.

Page 261, Note 6. *Melanoplus macneilli* is very probably *M. fluviatilis* Brun.

Page 262, Note 9. Dr. Bergroth writes that *Nabis elongatus* is preoccupied. The original is *elogantus* in the check list. Comparison with long-winged *vicarius* is desirable before re-naming it.

Page 309, in table, for 59 read 57, and for 743 read 741.

Page 310, in table, for 59 read 57.

Page 314, line 5, for 1587 read 481; line 16, after *stubble* insert *meadows*; line 17, after *pastures* strike out *and meadows*, and after 1500 strike out *each*.

Page 315, last line, for 553 read 481.

Page 362, line 7 from bottom, for *longa* read *parvilamellata*.

Page 373. As a second entry in synonymy insert as follows:

1854. *Nothrus bistriatus*, Nicolet, *Acariens des Environs de Paris*, p. 397, Pl. VII., Fig. 7.

Page 376, line 13 from bottom, for *Oribata* read *Oribates*.

Page 378, line 1, for XXV. read XXXV.

Page 384, after line 5 insert as follows:

N. bipilis Hermann. Mem. Apt., p. 95.

In moss, Arcola and Parker, Ill.

Page 384, line 5 from bottom, for *pyrostigma* read *pyrostigmata*.

Page 386, after line 11 from bottom insert as follows:

H. bistrinata Nicolet. *Acariens des Environs de Paris*, p. 397, Pl. VII., Fig. 7.

Under logs and in moss, Urbana and Arcola, Ill.

Page 388, line 12, for *sphærum* read *sphærule*.

ARTICLE V.—Notes on Species of North American Oligochaeta. V.
The Systematic Relationships of *Lumbriculus* (*Thinodrilus*)
inconstans (Smith). BY FRANK SMITH.

When this species was described by the writer (1895) it was thought that the differences between it and previously described species were such as to warrant the recognition of a new genus; hence the genus *Thinodrilus*. Michaelsen in his great work on the *Oligochaeta* (1900) saw fit to include this species in the genus *Trichodrilus* Claparede with the two European species. Recent papers on the reproductive organs of *Lumbriculus variegatus* (Müller) by Wenig (1902) and Hesse (1902) have extended our knowledge of that species and have shown that it is in some particulars very similar to *Thinodrilus inconstans*, and as it now seems to the writer that there is more reason for including the latter species in the genus *Lumbriculus* than in the genus *Trichodrilus*, it will be referred to in the following discussion as *Lumbriculus inconstans*.

We will first consider the chief points in which *L. inconstans* differs more from *L. variegatus* than from the two species of *Trichodrilus* (*T. allobrogum* Claparede and *T. pragensis* Vejdovsky).

Albumen Gland.—An albumen or copulatory gland, which is described and figured by Vejdovsky (1884) as occurring in somite IX in *L. variegatus*, is lacking in *Trichodrilus* and in *L. inconstans*. No reference is made to such an organ by Wenig and Hesse in their recent papers on *L. variegatus*, and Michaelsen (1903, p. 60) has recently raised the question as to its occurrence, and queries whether the structures seen by Vejdovsky may not have been rudiments of efferent reproductive organs. It should not be overlooked that the structure of the albumen gland is described by Vejdovsky (1884, p. 149) as similar to that of the spermathecæ, and that Wenig (1902) describes and figures a single spermatheca in IX but makes no reference to an albumen gland. Vejdovsky used the presence

or absence of an albumen gland as the basis for the separation of the *Lumbriculidae* into two groups, but without presenting any reason for believing that such a character should be considered of especial importance in determining systematic relationships, and I am disposed to assume that it has at the most no greater significance than that of a specific character.

Positions of Spermiducal Pores and Gonads.—The spermiducal pores are usually on VIII in *L. variegatus*, but Vejdovsky (1895) found them on VII in one specimen. Wenig found but one spermiducal pore in each of the specimens examined by him, and that on VIII. In *L. inconstans* the spermiducal pores are on X in two of the specimens studied and on XI in another. In the two species of *Trichodrilus* they are on X. With such individual variability in mind, it seems reasonable to consider the position of the spermiducal pores as of no more than specific importance. In *L. variegatus* there is one pair of testes and one pair of spermiducal funnels in VIII, and there are two pairs of ovaries in IX and X. In *L. inconstans* there are two pairs of testes and two pairs of spermiducal funnels in IX and X, and two pairs of ovaries in XI and XII. In the European species of *Trichodrilus* there is uncertainty about the testes. There are two pairs of spermiducal funnels in IX and X and one pair of ovaries in XI. With reference to the position of the gonads our species is nearer to *Trichodrilus*, while in respect to the number of ovaries it is more like *L. variegatus*.

We will next consider several important respects in which *L. inconstans* more closely resembles *L. variegatus* than it does the European species of *Trichodrilus*.

Setæ.—In *L. variegatus* and *L. inconstans* the setæ are cleft; in *Trichodrilus* they are simple. While it is true that in some lumbriculid species the setæ may be partly simple and partly cleft, yet to my knowledge there has been no occasion for placing in the same genus species with setæ all simple and other species with setæ all cleft, except in the genus *Trichodrilus* as defined by Michaelsen (1900, p. 58) in order that it might include the species *inconstans*.

Vascular System.—In *L. variegatus* a pair of transverse vessels connects the dorsal and ventral vessels in each of several anterior somites. They are situated just anterior to the septum. They are small in somites back of XX, and are so close to the wall of the intestine and so covered by chloragogue cells that they are seldom recognizable. A single pair of cæciform, contractile, branched vessels, connected only with the dorsal vessel, is contained in the anterior part of each somite posterior to XV (Ratzel, 1868), and, according to Dieffenbach (1886), smaller ones are found as far forward as IX. The description of the circulatory system of *L. inconstans* in my earlier treatment of that species (1895) was very incomplete and did not give enough data for comparisons, but as far as transverse vessels are concerned the conditions existing in that species and in *L. variegatus* are closely similar. In *L. inconstans* the paired vessels which connect the dorsal and ventral vessels, in the posterior part of each somite, are recognized with difficulty posterior to XVII, and the cæcal branches of the dorsal first appear in XI and then occur regularly, there being one pair, and only one, in each somite. In each of the two species of *Trichodrilus*, in the middle region of the body there are four or more cæcal branches of the dorsal vessel on each side in each somite, instead of a single one as in each species of *Lumbriculus*.

Spermatheca.—In *L. variegatus* there is much variability in the position and arrangement of the spermatheca. Vejdovsky reported three pairs in X—XII; Hesse found four pairs in X—XIII; and Wenig found them more or less asymmetrically distributed in IX—XV. In *L. inconstans* I have found five pairs in XI—XV or in XII—XVI. In *Trichodrilus* but one or two pairs are found, and these are in XI or in XI and XII. The spermathecal pores of both species of *Lumbriculus* are at least as high up on the sides as the ends of the transverse diameter, while the pores of both species of *Trichodrilus* are described as behind the ventral setæ.

Atrium and Penis.—Vejdovsky (1895) describes and figures the atrium and penis of *L. variegatus*. Hesse did not at first (1894) recognize the presence of the penis, but later (1902) reexamined his preparations and found it to be present. Wenig confirmed the observations of Vejdovsky. In my former description of *L. inconstans* the following statement occurs: "Whether or not a definite penis is developed I am unable to state." A reexamination of my specimens has revealed the presence of a penis, formerly overlooked because of its great transparency. This organ and the atrium are both very similar to those of *L. variegatus*.

Besides these more important characters in which *L. inconstans* resembles *L. variegatus* much more closely than it does the species of *Trichodrilus*, there are others of less importance, but nevertheless significant, in which the two former species are closely similar. (1) They are both greenish anteriorly. (2) The usual number of somites in each is more than double the number in the two species of *Trichodrilus*. (3) They are noticeably similar in the extreme infrequency with which sexually mature specimens are found. I have examined hundreds of specimens of *L. inconstans*, taken at various times of the year, and have found but three with reproductive organs developed. (4) The form of the brain is quite similar in the two species of *Lumbriculus* and quite different from that of *Trichodrilus pragensis* as described and figured by Vejdovsky (1876). (5) In both species of *Lumbriculus* nephridia are found in the same somite as are the genital ducts, which is not the case in *Trichodrilus*. (6) The sperm-sacs in both species of *Lumbriculus* extend posteriorly from the atrial somite through a considerable number of somites, while in *Trichodrilus pragensis* sperm-sacs are apparently formed anterior to the atrial segment as well as posterior to it (Vejdovsky, 1876, p. 548, Fig. 2).

If we follow somewhat closely the general type of generic and specific definitions adopted by Michaelsen (1900), we may define *Lumbriculus* and its two species in the following terms.

Lumbriculus Grube.

Prostomium rounded. Setae cleft. One pair of spermiducal pores. Two pairs of oviducal pores. Three pairs, or more, of spermathecal pores, open laterally on some of somites IX—XVI. Dorsal and ventral vessels connected in posterior part of each somite by a pair of transverse vessels; the dorsal vessel in each somite with one pair of contractile caecal transverse appendages except in a few anterior somites. Sperm-ducts open into a single atrium or pair of atria provided with protrusible penis. Two pairs of ovaries and of oviducal funnels. Spermathecae simple; three pairs or more in somites posterior to atria.

Lumbriculus variegatus (O. F. Müller).

In life reddish to dark brown, anteriorly greenish. Prostomium rounded conical, length $1\frac{1}{2}$ times the basal width, with "head" pore at the apex. Spermiducal pores on VIII (exceptionally on VII), posterior to ventral setae. Two pairs of oviducal pores, IX/X and X/XI. Spermathecal pores on some of somites IX—XV, sometimes asymmetrically distributed. Brain anteriorly slightly concave, posteriorly with a deep, rounded trilateral incision. Transverse vessels of I—VIII much branched, forming a connected vascular plexus, the following ones simple; contractile caecal transverse appendages of the dorsal vessel beginning in IX, at first short and simple but becoming longer and branched in succeeding somites. One pair of testes and one pair of spermiducal funnels in VIII. Atria pyriform, one pair in VIII (exceptionally in VII), or single. Two pairs of ovaries and of oviducal funnels in IX and X. Spermathecae simple, three pairs or more in some of somites IX—XV, sometimes asymmetrically distributed. An unpaired copulatory (albumen) gland in IX. (?) Length, 40—80 mm. Diameter, 1—1.5 mm. Number of somites, 140—200, or more.

Lumbriculus inconstans (Smith).

In life reddish, anteriorly greenish. Prostomium rounded, length $1\frac{1}{2}$ times the basal width. Spermiducal pores on X (exceptionally on XI). Two pairs of oviducal pores, XI/XII and XII/XIII. Spermathecal pores on XI—XV or XII—XVI. Brain anteriorly, but slightly, concave, posteriorly with a deep, rounded trilateral incision. Contractile cæcal transverse appendages of the dorsal vessel beginning in XI, becoming larger and more branched in succeeding somites. Two pairs of testes and two pairs of spermiducal funnels in IX and X. Atria pyriform, one pair in X (exceptionally in XI). Two pairs of ovaries and two pairs of oviducal funnels in XI and XII. Five pairs of spermathecæ in XI—XV or XII—XVI. No copulatory (albumen) gland. Length, 30—60 mm. Diameter, .6—.8 mm. Number of somites, 150—200, or more.

If the above disposition of the two species under discussion be correct, and if the views of Michaelsen (1902) concerning the phylogenetic relationships of the lumbriculid genera are well founded, the species *inconstans* seems to have the more primitive condition of spermiducal structures, and *L. variegatus* may have been derived from it by the disappearance of the anterior pair of testes and of sperm-ducts and a reduction in the number of anterior somites. The specimen of *L. inconstans* referred to above, in which the spermiducal pores are on a somite posterior to the somites containing the testes, presents a condition normal to families higher than the *Lumbriculidæ* but not ordinarily found in that family.

The transfer of the American species from the genus *Trichodrilus* to *Lumbriculus* leaves the former genus much more homogeneous and simplifies its definition.

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