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STEPHEN A. FORBES, PH. D., LL. D.,
DIRECTOR

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ART. VII. TWO NEW SPECIES OF LUMBRICIDÆ FROM ILLINOIS

BY

FRANK SMITH, A. M., AND ELIZABETH MAE GITTINS, M. A.

ART. VIII. TWO NEW VARIETIES OF EARTHWORMS WITH A KEY TO DESCRIBED SPECIES IN ILLINOIS

BY

FRANK SMITH, A. M.

ERRATA

Page 49, line 7 from bottom, page 69, line 8 from bottom, page 85, last line, and page 86, line 11 from bottom. for *chamæchrista* read *chamæcrista.*
Page 71, line 2 from bottom, for *Tetraophthalmus,* read *Tetraopes.*
Page 75, line 3 (second column) below first heading, for *Cistudo* read *Terrapene.*
Page 76, last line in first list, for *brevicaudis* read *brevicauda.*
Page 87, line 2 (second column) below first heading, for *carisce* read *cardisce.*
Page 214, lines 4, 7, and 11 above heading, for *flavicingulata* read *flavicingula.*
Page 283, line 19 from bottom, for *Simulidæ* read *Simuliidæ.*
Page 289, line 7, for *Bezzia* read *Probezzia.*
Page 409, line 23, after *p.* read *526.*
Page 531, line 12 from bottom, for *dissimilis* read *nivoriundus.*

ARTICLE VIII.—*Two New Varieties of Earthworms with a Key to described Species in Illinois.** By FRANK SMITH.

The collections of earthworms made by the writer in 1895 at Havana, Illinois, for the Illinois State Laboratory of Natural History, contain specimens of an undescribed form which closely resembles *Helodrilus (Bimastus) gieseleri* (Ude) and is here described as a variety of that species.

HELODRILUS (BIMASTUS) GIESELERI HEMPELI n. var.

(Pl. XLI, Fig. 1–3)

Definition.—Color of living worm on dorsal side, brownish red tinged with purple; somewhat more pronounced on a few anterior and posterior somites. Length, extended, 65–75 mm. Maximum diameter, 2.5–3.5 mm. at the clitellum. Somites, usually 105–115. Prostomium epilobic, about ½. Setæ closely paired, *ab* = 1⅓ *cd*, *aa* a little greater than *bc*, *dd* nearly ½ circumference. First dorsal pore, V/VI. Clitellum, XXII–XXIX or ½ XXX; incomplete ventrally. Tubercula pubertatis lacking. Spermiducal pores on XV, conspicuous; surrounding glandular areas swollen, but externally confined to XV. Septa VI/VII–XIV/XV, slightly thickened. Sperm sacs, two pairs, in XI and XII. Spermathecæ lacking.

The description is based on specimens collected at Havana, Illinois, under the bark of fallen timber in the Illinois River bottom-lands. Specimens were very abundant in April and May of 1895, and freshly formed cocoons were abundant during the latter half of April and throughout May. More recently, specimens have been obtained at several places in Champaign County near Urbana, some of them from fallen timber and some from beneath a straw stack.

EXTERNAL CHARACTERS

The brownish red color is generally distributed along the dorsal half of the worm, being a little stronger on the anterior and posterior ends. The coloration extends to about midway between *b* and *c*, the ventral part of the body being without pigment. The clitellum is

*Contributions from the Zoological Laboratory, University of Illinois, No. 42.

flesh-colored. The length varies with the state of contraction and size of specimen from 40 mm. to 75 mm., and under the influence of anesthetics specimens may exceed 75 mm. There is considerable variation in size. Some mature specimens in moderate extension may be 50 × 2.5 mm. and others 75 × 3.5 mm. The number of somites in apparently complete specimens varies from 100 to 120, with intermediate numbers more common. The setæ are closely paired and, posterior to the clitellum, *aa* is slightly greater than *bc* and five to seven times greater than *ab*, while *ab* equals about 1⅓ *cd*, and *dd* is slightly less than one half of the circumference. Anterior to the clitellum, *ab* and *cd* increase a little and *bc* is correspondingly diminished.

The clitellum is saddle-shaped and the ventral margin barely includes the ventral setæ. There is a slight increase in the thickness of the hypodermis on the posterior part of XXI, but at the anterior border of XXII there is abrupt increase and the beginning of the clitellum proper. There is marked uniformity in this respect among the many specimens examined. In many cases the clitellum ends abruptly at the posterior margin of XXIX, and in others the dorsal part of the clitellum encroaches on XXX but not beyond the middle of the somite. Tubercula pubertatis are lacking. The paired spermiducal pores are located on XV, about one third of the distance from *b* to *c*. The swollen glandular areas surrounding the pores are conspicuous, and the distance between the external grooves which separate XV from adjacent somites is about twice as great in the region of the pores as elsewhere. The oviducal pores are small apertures slightly dorsad of *b* on XIV. The nephridiopores are in positions similar to those of other *Lumbricidæ*. They are near the anterior borders of the somites and some of them are slightly dorsad of *b*, while others are approximately midway between *d* and the mid-dorsal line.

INTERNAL CHARACTERS

The septa of the anterior somites are but slightly thickened, those of VI/VII, VII/VIII, and XIII/XIV being slightly thicker than the others. The alimentary tract is similar in parts and relations to those of other species of *Helodrilus*. The esophagus is relatively small in diameter in V–IX. The calciferous gland has the usual relations. The esophagus abruptly widens in X, and the two lateral pouches of the gland are formed. Extending from these pouches to the middle of XIV, there are about 40 longitudinal partitions arranged radially around the lumen of the esophagus. The crop is in XV and XVI and the gizzard in XVII and XVIII. The "hearts" are in VII to XI,

and those of XI are similar in size to the others. The excretory and nervous systems have the ordinary structures and relations.

The spermaries and spermiducal funnels have the usual positions and relations in X and XI and the spermiducal pores are on XV. The terminal parts of the sperm ducts are surrounded by rather large masses of gland cells which encroach on the cavity of XVI. There are but two pairs of sperm sacs, one pair in XI and one in XII. The various female reproductive organs have the usual positions and relations except that spermathecæ are entirely lacking.

A comparison of the above description with that of *Helodrilus giesceleri* (Ude)—see Ude ('95: 127)—will show very close correspondence throughout except in the position of the clitellum, which in the latter species begins abruptly on XX instead of XXII. I have specimens collected from the eastern parts of Florida by Mr. Adolph Hempel which correspond very closely with Ude's description even to the presence of the groove separating the clitellar part of XX from that of the following somites. A few specimens in the same collection show but little clitellar development on XX, the strongly thickened part beginning on XXI. I assume that these Florida specimens are *Helodrilus giesceleri*. They have about 40 longitudinal partitions in the calciferous gland as does the form described above. In view of the connecting forms, there seems insufficient basis for recognizing the new form as a distinct species, but because of the great uniformity in the hundreds of Illinois specimens examined, there does seem to be justification for treating it as a variety. No connecting forms have been noticed in the Illinois material.

Diplocardia singularis fluviatilis n. var.

(Pl. XLI, Fig. 4)

Definition.—Color of living worm, strongly brown on anterior dorsal surface. Length, extended, 60–100 mm. Diameter, 2–2.5 mm. Somites, 100–120. Setæ of pairs rather widely spaced: posterior to clitellum, $\frac{2}{3}\ aa = 2ab = bc = cd$; $dd = \frac{1}{2}$ circumference; ventral setæ lacking on XIX; ventral setæ of XVIII and XX modified as penial setæ; spermathecal setæ not modified. Clitellum, XIII–XVIII; nearly as thick ventrally as dorsally except on XVII and XVIII. First dorsal pore, VIII/IX or IX/X. Spermathecal pores, VI/VII, VII/VIII, and VIII/IX. Prostate pores on XVIII and XX. Spermiducal pores near anterior margin of XIX. Genital papillæ paired, near XVII/XVIII and XX/XXI. Septa VII/VIII and VIII/IX strongly thickened; IX/X somewhat less strongly, and V/VI, X/XI, and XI/XII very slightly thickened. Gizzards in V and VI. Last

"hearts" in XII. Dorsal vessel single. Alimentary tract very narrow in XVI and abruptly enlarged in XVII. Spermathecæ in VII, VIII, and IX. Sperm sacs in IX and XII.

Among the earthworms collected in 1895 at Havana, were many specimens of this small type of *Diplocardia* which in anatomical characters corresponds very closely with the revised description of *D. singularis* (Ude) —see Ude ('95: 129). In a former paper by the writer ('95b: 285), these worms were treated as belonging to Ude's species, and in a later paper ('00: 442) they were listed as *D. singularis,* which species was mentioned as of frequent occurrence at Havana and Urbana. The specimens found at Urbana are without pigment and are of considerably stouter proportions than the Havana specimens. They occur in upland wooded situations as well as in treeless areas. I think that the Urbana specimens are without doubt representative of Ude's *D. singularis,* the type specimens of which were collected at Danville, Illinois, only thirty miles east of Urbana. The Havana specimens are very heavily pigmented anteriorly and quite slender. They are very abundant in the muddy banks of Spoon River near its entrance into the Illinois River, and are so situated that they are submerged for weeks at a time during high water when the bottom-lands are flooded.

The recognition of the Havana specimens as belonging to a distinct variety, as named and described above, will simplify subsequent treatment of still other material which is closely related to *D. singularis* and *D. communis* Garman. Despite the fact that some leading investigators of the *Oligochæta* do not consider the last-named forms as constituting distinct species, it seems to the writer that *D. singularis,* with its single dorsal vessel and its clitellum nearly as thick ventrally as dorsally, must be given rank as a species distinct from *D. communis* with its double dorsal vessel and saddle-shaped clitellum.

Explanations with Regard to Key

As the following key may often be utilized by persons not familiar with the various symbols and terms in common use in systematic papers dealing with earthworms, it seems desirable that some of these be explained.

Roman numerals are generally used to designate the number of a somite, counting from the anterior end. When the separation between somites is obscure, advantage may be taken of the fact that in the species found in Illinois the first setæ are always borne on the second somite. Externally the limits of somites are ordinarily indicated by transverse (intersegmental) grooves, while internally the

TABULAR KEY

Clitellum	Tubercula pubertatis	Prostate pores	Spermiducal pores	Spermathecal pores	Setæ	Sperm sacs	Last "hearts"	No. of somites	Length cm.	Color (antero-dorsal)	Name
XIII–XVIII, saddle	.....	XVIII, XX	XIX	VII/VIII, VIII/IX	Wide	IX, XII	XIII	136–157	20–25	Brown	*Diplocardia riparia*
XIII–XVIII, saddle	.....	XVIII, XX	XIX	VII/VII, VII/VIII, VIII/IX	Wide	IX, XII	XII	123–165	20–30	Pale	*D. communis*
XIII–XVIII, cingulum	.....	XVIII, XX	XIX	VI/VII, VII/VIII, VIII/IX	Wide	IX, XII	XII	95–115	5–10	Pale	*D. singularis*
XIII–XVIII, cingulum	.....	XVIII, XX	XIX	VI/VII, VII/VIII, VIII/IX	Wide	IX, XII	XII	100–120	6–10	Brown	*D. singularis fluviatilis*
XIII–XVIII, saddle	.....	XIX, XXI	XX	VIII, IX	Wide	IX, XII	XII	100–125	7–15	Pale	*D. verrucosa*
XV–XXV	.....	XXIII–XXVI	XIX	VI/VII, VII/VIII, VIII/IX	Close	XI, XII	XI	165–220	15–20	Pink with blue iridescence	*Sparganophilus eiseni*
XXII, XXIII–XXVI, XXVII	XXIII–XXV, XXVI	.....	XIII	VIII/IX, IX/X, dorsal	Close	IX–XII	XI	70–90	3–6	Brown	*Helodrilus tetraedrus*
XXII, XXIII–XXVII	XXIII–XXV, XXVI	.....	XV	VIII/IX, IX/X, dorsal	Close	IX–XII	XI	70–90	3–6	Brown	*H. tetraedrus hercynius*
XXIV, XXV or XXVI–XXXII	XXVIII–XXX, XXXI	.....	XV	IX/X, X/XI, dorsal	Close	IX–XII	XI	80–110	6–13	Brown and buff (bands)	*H. foetidus*
XXV, XXVI–XXXII	XXIX–XXXI	.....	XV	IX/X, X/XI, dorsal	Close	IX–XII	XI	120–150	3–8	Pale red	*H. roseus*
XXVII–XXXIV	XXXI–XXXIII	.....	XV	IX/X, X/XI	Close	IX–XII	XI	105–240	6–17	Brown-red	*H. caliginosus trapezoides*
XXVI–XXXI	XXVIII–XXX	.....	XV	IX/X, X/XI	Wide	IX, XI, XII	XI	60–110	4–7	Red	*H. subrubicundus*
XXVI–XXXI	XXIX–XXX (indistinct)	.....	XV	None	Wide	XI, XII	XI	90–105	4–7	Red	*H. tenuis*
XXIII–XXXII	None	.....	XV	None	Close	XI, XII	XI	98–122	6–9	Rose-red	*H. longivinctus*
XXVII–XXXVII	None	.....	XV	None	Close	XI, XII	XI	100–142	10–14	Chestnut-brown	*H. setekí*
XXII–XXIX	None	.....	XV	None	Close	XI, XII	XI	105–135	5–8	Brown-red	*H. gieseleri hempeli*
XXX–XXXV	XXXI–XXXIV	.....	XV	IX/X, X/XI	Wide	IX–XII	XI	160–165	5–16	Pink and blue-gray	*Octolasium lacteum*
XXXII–XXXVII	XXXIII–XXXVI	.....	XV	IX/X, X/XI	Close, at middle	IX, XI, XII	XI	110–180	10–30	Brown-violet	*Lumbricus terrestris*

septa serve this purpose. Not infrequently, and especially in the anterior part of the worm, there is a considerable lack of correspondence in the external and internal boundaries of somites thus indicated. Septa and intersegmental grooves for any two somites are represented by the same formula—for example, V/VI—the context showing which is meant. In all of our species except a few found in greenhouses there are but eight setæ per somite, and these are more commonly arranged in pairs. It is customary to indicate the setæ of either side by the use of the letters *a*, *b*, *c*, and *d*, the ventral-most seta being designated by *a*, the next by *b*, the next by *c*, and the dorsal-most one by *d*. If the distances *ab* and *cd* are less than one third of the distance *bc*, the setæ are said to be closely paired, and if otherwise, they are widely paired. The clitellum may be incomplete ventrally or, in some species of *Diplocardia*, it may be nearly as thick on the ventral surface as elsewhere. In the accompanying table the former condition is denoted by the term saddle and the latter by cingulum. Tubercula pubertatis are glandular ridges closely associated with the ventral edges of the clitellum on some of its somites.

The spermathecæ are pouches which open to the exterior and receive sperm cells from another individual. They are the same as the seminal receptacles mentioned in many text-books. The sperm sacs open into the cavity of X or XI and store temporarily the sperm cells produced in those somites. Each sperm sac lies in a somite adjacent to the one into which it opens. These organs are often called seminal vesicles in the text-books. The prostate glands are not found in the *Lumbricidæ* and hence are not ordinarily mentioned in the text-books. They are large glands more or less closely associated with the external openings of the sperm ducts, and in indigenous Illinois species open separately (prostate pores) from them on neighboring somites.

The foregoing key includes all but two of the described species of which representatives have been collected in Illinois, and gives the main characters necessary for their identification. Because of the large number of species in the genus *Pheretima* and the consequent difficulty in determining them, *P. heterochaeta* and *P. hawayana* are not included in the key. Additional matter concerning distribution and habitats is included in the following text, as are also, in brackets, citations to descriptions of most of the species.

Diplocardia riparia Smith (Pl. XLI, Fig. 10–12).—[Smith, '95a: 138.] Abundant in the rich soil of the bottom-land forests of the Illinois and the Kaskaskia rivers.

Diplocardia communis Garman.—[Garman, '88: 47.] The first species of the genus to be described. It differs from its congeners in having a double dorsal vessel extending throughout the greater part of the length of the body. Abundant in the prairie soil of central Illinois. Nothing is known of the limits to its range.

Diplocardia singularis (Ude).—[Ude, '95: 129.] Common in the soil of the upland regions of east-central Illinois.

Diplocardia singularis fluviatilis n. var. (Pl. XLI, Fig. 4).—Abundant in the soil of the bottom-land forests at the junction of the Illinois and Spoon rivers.

Diplocardia verrucosa Ude (Pl. XLI, Fig. 13).—[Ude, '95: 133.] Described from specimens collected at Omaha, Nebraska. Abundant in the soil of the bottom-land forests of the Illinois and Kaskaskia rivers.

Sparganophilus eiseni Smith (Pl. XLI, Fig. 6–9).—[Smith, '95a: 142.] An aquatic species which is abundant in the mud of the bottom and margins of many rivers and lakes east of the Mississippi River.

Helodrilus tetraedrus (Savigny) and *H. t. hercynius* (Michaelsen).—[Michaelsen, '00: 471–473.] Amphibious, and widely distributed throughout the United States and in many other parts of the world.

Helodrilus foetidus (Savigny).—[Michaelsen, '00: 475.] A conspicuously transversely banded species of nearly world-wide distribution where Europeans have settled, and especially abundant in compost heaps and barnyards.

Helodrilus roseus (Savigny).—[Michaelsen, '00: 478.] An abundant, widely distributed species which lives in soil. It usually has conspicuous papillæ associated with some of the setæ bundles of IX and X.

Helodrilus caliginosus trapezoides (Dugès), Pl. XLI, Fig. 14 and 15.—[Michaelsen, '00: 483.] The most abundant species in the long-settled parts of the United States, and found almost universally where Europeans have settled. It is easily recognized by the conspicuous glandular pads associated with the ventral setæ of IX–XI, XXVIII, XXX, and XXXII–XXXIV.

Helodrilus subrubicundus (Eisen).—[Michaelsen, '00 : 490.] This species is widely distributed in the Northern Hemisphere, and in other parts of the world where Europeans have settled. In Illinois, specimens have most frequently been found in situations subject to sewage contamination.

Helodrilus tenuis (Eisen).—This species was named in 1874 by Eisen, who described only the external characters. These are insufficient to fix the identity of the species. An examination of specimens

of the original material given by Dr. Eisen to the United States National Museum shows that the internal organization is the same as that described for *H. constrictus* (Rosa). It is abundant and widely distributed in the United States, including Alaska. It is most commonly found under the bark of fallen timber and in leaf mold.

Helodrilus longicinctus Smith and Gittins ['15: 548].—Common in the soil of lawns and parkings at Urbana, Illinois. Nothing is yet known of its further distribution.

Helodrilus zetcki Smith and Gittins ['15: 545].—Common in and under decaying logs in central Illinois and northern Michigan, and probably has a quite extensive range east of the Mississippi River.

Helodrilus gieseleri hempeli n. var. (Pl. XLI, Fig. 1–3).—Most commonly taken under the bark of fallen timber. Found in central Illinois.

Octolasium lacteum Örley (Pl. XLI, Fig. 16 and 17).—[Michaelsen, '00: 506.] Very abundant in the soil of many cultivated regions of the Northern Hemisphere, and in other places where Europeans have settled.

Lumbricus terrestris L., Müller.—[Michaelsen, '00: 511.] This is the species most commonly described in text-books. It occurs throughout Europe and the northern part of the United States. In the Eastern United States it is abundant as far south as Washington, D. C. Its distribution in Illinois is apparently local, and is due, chiefly if not altogether, to its introduction by white settlers. Its large size, strongly flattened posterior end, marked coloration, and the distinctive position of the clitellum readily distinguish this species from other Illinois earthworms.

Pheretima heterochaeta (Michaelsen).—This species has been collected in a greenhouse at Urbana. It is found in open fields in several of the Gulf States, and is very widely distributed in the warmer parts of the world. In common with other species of the genus it has numerous setæ per somite, and it differs from most of them in having the ventral setæ much larger than the other setæ and the spaces between them somewhat greater.

Pheretima hawayana (Rosa).—Under the name of *Perichæta bermudensis*, this species is reported by Harper ('05: 18) as occurring in a greenhouse at Evanston, Illinois.

Helodrilus longus (Ude), *H. chloroticus* (Savigny), *H. parvus* (Eisen), and *Lumbricus rubellus* Hoffmeister have been collected in adjacent states and their occurrence in Illinois seems probable.

Urbana, Illinois, August 5, 1915.

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EXPLANATION OF PLATE*

PLATE XLI

Helodrilus gieseleri hempeli

FIG. 1. Dorsal view.
FIG. 2. Ventral view of anterior end.
FIG. 3. Cocoon.

Diplocardia singularis fluviatilis

FIG. 4. Dorsal view.

*All figures of natural size, and from drawings by Lydia M. Hart (Green).

*Diplocardia eiseni**

FIG. 5. Dorsal view.

Sparganophilus eiseni

FIG. 6. Dorsal view.
FIG. 7. Ventral view of anterior end.
FIG. 8 & 9. Cocoons.

Diplocardia riparia

FIG. 10. Dorsal view.
FIG. 11. Ventral view of anterior end.
FIG. 12. Cocoon.

Diplocardia verrucosa

FIG. 13. Dorsal view.

Helodrilus caliginosus trapezoides

FIG. 14. Dorsal view.
FIG. 15. Ventral view of anterior end.

Octolosium lacteum

FIG. 16. Dorsal view of small specimen, showing ordinary appearance.
FIG. 17. Dorsal view of large specimen which has been freed from earthy matter in the intestine.

* The drawings from which this plate was made, were originally intended for a paper of somewhat different scope, but this figure of a Florida species is included, since Michaelsen's description of it (1894) was not illustrated. The species is not known to occur in Illinois.

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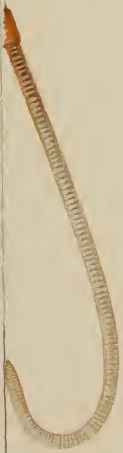


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