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CHECKLIST, DISTRIBUTION AND KEY TO THE LUMBRICIDAE IN TENNESSEE

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ABSTRACT

A survey including all 95 counties in the state of Tennessee produced 26 species of the earthworm family Lumbricidae. Fourteen of the species have not been previously recorded from the state and one species has not been previously reported from North America. The distribution of these 26 species in Tennessee and a key to their identification is included.

INTRODUCTION

The first checklist of North American earthworms was prepared by Gates in 1942. Gates assembled published references and distribution records for more than 200 species of earthworms. Surveys or checklists of earthworm species exist for only two of the eight states adjoinng Tennessee, *i.e., Arkansas* (Causey, 1952 and 1953) and Missouri (Olson, 1936). The author has completed a four year survey of the earthworms of Tennessee; this survey included collections from all ninety-five counties. The results of this survey include 792 new county records, 14 new records for Tennessee and one new distribution record for North America. For more detailed information concerning species distribution, habitat requirements and diagnoses, the reader *et al.* (1973).

TENNESSEE LUMBRICIDAE AND THEIR DISTRIBUTION

The following twenty-six species are the Lumbricidae reported from Tennesse to date. Synonomy and counties recorded for each species are given.

1. *Allolobophora chlorotica* (Savigny, 1826)—*Allolopophora canberica* Friend; *Helodrilus chloroticus* Michaelsen.

Tennessee Distribution: Anderson, Blount, Carter, Claiborne, Cocke, Gibson, Grainger, Greene, Hamblen, Hawkins, Humphreys, Jefferson, Johnson, Knox, Loudon, Meigs, Morgan, Scott, Sevier, Sullivan and Washington. *A. chlorotica* was first reported from Tennessee by Reynolds (1972).

2. *Allolobophora longa* Ude, 1885—*Allolobophora lactea* Friend; *Allolobophora terrestries* Rosa; *Helodrilus longus* Michaelsen.

Tennessee Distribution: Blount and Roane counties. *A. longa* was first reported from Tennessee by Reynolds, *et al.* (1973).

3. *Allolobophora muldali* (Omodeo, 1956)—*Allolobophora minima* Muldal; *Bimastos muldali* Omodeo.

Tennessee Distribution: Henderson and Obion counties. *A. muldali* was first reported from Tennessee by Reynolds, *et al.* (1973).

4. *Allolobophora trapezoides* (Duges, 1828)—*Allolobophora mariensis* Stephenson; *Allolobophora iowana* Gates.

Tennessee Distribution: All counties except Houston. *A. trapezoides* was first reported from Tennessee by Gates (1959).

5. *Allolobophora tuberculata* Eisen, 1874—*Allolobophora similis* Friend; *Allolobophora arnoldi* Gates.

Tennessee Distribution: Anderson, Blount, Bradley, Cheatham, Grainger, Greene, Humphries, Jackson, Roane, Sequatchie, and Union counties. *A. tuberculata* was first reported from Tennessee by Reynolds, *et al.* (1973).

6. *Allolobophora turgida* Eisen, 1873—*Allolobophora caliginosa* Evans; *Allolobophora molita* Gates.

Tennessee Distribution: All counties except Cheatham, DeKalb, Macon, Shelby, Trousdale, Van Buren and Warren. *A. turgida* was first reported from Tennessee by Reynolds, *et al.* (1973).

7. *Bimastos beddardi* (Michaelsen, 1894)—*Allolobophora beddardi* Michaelsen; *Helodrilus beddardi* Michaelsen.

Tennessee Distribution: Cannon, Cheatham, Decatur, Fayette, Fentress, Giles, Hardeman, Henderson, Morgan, Sevier and Tipton counties. *B. beddardi* was first reported from Tennessee by Reynolds, *et al.* (1973).

8. *Bimastos gieseleri* (Ude, 1895)—*Allolobophora gieseleri ude; Helodrilus gieseleri* Michaelsen.

Tennessee Distribution: Chester County. *B. gieseleri* was first reported from Tennessee by Reynolds, *et al.* (1973).

9. *Bimastos heimburgeri* Smith, 1928—*Helodrilus heimburgeri* Smith.

Tennesse Distribution: Anderson, Bedford, Benton, Bledsoe, Bradley, Campbell, Carroll, Chester, Clay, Cocke, Cogee, Crockett, Cumberland, Decatur, Dekalb, Dickson, Dyer, Fayette, Fentress, Franklin, Gibson, Giles, Hamilton, Hancock, Hardeman Hardin, Haywood, Henderson, Henry, Hickman, Jackson, Knox, Lauderdale, Lewis, Lincoln, McMinn, McNairy, Macon, Marshall, Maury, Meigs, Monroe, Moore, Montgomery, Morgan, Obion, Overton, Polk, Putnam, Rhea, Roane, Robertson, Sequatchie, Sevier, Stewart, Sullivan, Sumner, Unicoi, Union, Van Buren, Warren, Wayne, Weakley, Williamson and Wilson counties. *B. heimburgeri* was first reported from Tennessee by Reynolds *et al.* (1973).

10. *Bimastos longicinctus* Smith & Gittins, 1915—*Helodrilus longicinctus* Smith & Grittins.

Tennessee Distribution: Bedford, Bledsoe, Bradley, Campbell, Carroll, Chester, Clay, Cocke, Crockett, Cumberland, Decatur, Dyer, Fayette, Franklin, Gibson, Giles, Hancock, Hardeman, Hardin, Haywood, Henderson, Henry, Hickman, Houston, Jackson, Knox[2], Lawrence, Lewis, Lincoln, Macon, Madison, McMinn, Meigs, Monroe, Montgomery, Obion, Overton, Putnam, Rutherford, Scott, Sevier, Smith, Tipton, Van Buren, Warren and Weakley counties. *B. longicinctus* was first reported from Tennessee by Reynolds (1972).

11. *Bimastos palustris* Moore, 1893—*Allolobophora palustris* Michaelsen; *Helodrilus palustris* Michaelsen.

Tennessee Distribution: Crockett and Stewart counties. *B. palustris* was first reported from Tennessee by Reynolds, *et al.* (1973).

12. *Bimastos parvus* (Eisen, 1874)—*Allolobophora parva* Eisen; *Helodrilus parvus* Michaelsen; *Eisenia parvus* Pop.

Tennessee Distribution: Carroll, Cheatham, Cocke, Decatur, DeKalb, Dickson, Fayette, Gibson, Hardeman, Lake, Lincoln, Madison, Obion, Robertson and Weakley counties. *B. parvus* was first reported from Tennessee by Reynolds, *et al.* (1973).

13. *Bimastos tumidus* (Eisen, 1874)—*Allolobophora tumida* Eisen; *Helodrilus tumidus* Michaelsen; *Helodrilus (B.) gieseleri* var. *hempeli* Smith.

Tennessee Distribution: All counties except Carter, Dickson, Grainger, Hawkins, Houston, Humphries, McMinn, Pickett, Roane, Robertson, Scott, Sevier, Stewart and Washington. *B. tumidus* was first reported from Tennessee by Gates (1959).

14. *Bimastos zeteki* Smith & Gittins, 1915—*Helodrilus zeteki* Smith & Gittins.

Tennessee Distribution: Anderson, Benton, Bledsoe, Blount, Campbell, Cannon, Cheatham, Chester, Clay, Cocke, Coffee, Crockett, Cumberland, Davidson, Decatur, DeKalb, Fayette, Fentress, Franklin, Giles, Grainger, Grundy, Hancock, Hardeman, Hardin, Henry, Hickman, Houston, Jackson, Knox, Lauderdale, Loudon, Madison, McMinn, Meigs, Monroe, Moore, Morgan, Obion, Overton, Perry, Pickett, Polk, Rhea, Roane, Scott, Sevier, Smith, Stewart, Trousdale, Van Buren, Wayne, Warren and Weakley counties. *B. zeteki* was first reported from Tennessee by Gates (1956).

15. *Dendrobaena octaedra* (Savingy, 1826)—*Dendrobaena boeckii* Eisen; *Helodrilus octaedra* Michaelsen.

Tennessee Distribution: Anderson, Bedford, Blount, Campbell, Carter, Claiborne, Cocke, Cumberland, Davidson, Grainger, Greene, Hamblen, Hardeman, Johnson, Moore, Polk, Putnam, Rhea, Roane, Sevier, Shelby, Sullivan and Unicoi counties. *D. octaedra* was first reported from Tennessee by Reynolds (1972).

16. *Dendrobaena rubida* (Savigny, 1826)—*Allolobophora tenuis* Eisen; *Allolobophora constricta* Rosa; *Allolobophora subrubicunda* Eisen; *Helodrilus (Dendrobaena) rubidus* Michaelsen; *Helodrilus (Bimastus) tenuis* Smith.

Tennessee Distribution: Anderson, Blount, Campbell, Cannon, Carroll, Carter, Claiborne, Clay, Cocke, Coffee, Cumberland, Dickson, Dyer, Fentress, Grundy, Hancock, Henderson, Hickman, Johnson, Knox, Lewis, Macon, Madison, Montgomery, Moore, Morgan, Obion, Putnam, Hhea, Roane, Sullivan, Unicoi, Wayne and White counties. *D. rubida* was first reported from Tennessee by Gates (1959).

17. *Eisenia foetida* (Savigny, 1826)—*Lumbricus annulatus* Hutton; *Endrilus annulatus* W. Smith; *Helodrilus foetidus* Michaelsen.

Tennessee Distribution: Bedford, Benton, Blount, Campbell, Carroll, Claiborne, Gibson, Grainger, Hamilton, Hardin, Humphries, Jefferson, Knox, Lawrence, Loudon, McNairy, Montgomery, Rhea, Wayne and Unicoi counties. *E. foetida* was first reported from Tennessee by Harman (1955).

18. *Eisenia rosea* (Savigny, 1826)—*Helodrilus roseus* Smith; *Eophila kulagini* Malevic; *Allolobophora rosea* Gerard.

Tennesse Distribution: Blount, Campbell, Carter, Cocke, Cumberland, Davidson, Fentress, Greene, Hamilton, Hancock, Hawkins, Loudon, Marion, Marshall, Monroe, Montgomery, Roane[2], Sevier, Sullivan, Unicoi and Union counties. *E. rosea* was first reported from Tennessee by Reynolds, *et al.* (1973).

19. *Eiseniella tetraedra* (Savigny, 1826)—*Allurus tetraedrus Eisen; Tetragonurus pupa* Eisen.

Tennessee Distribution: Anderson, Claiborne, Clay, Campbell, Grainger, Greene, Hamblen, Hamilton, Hawkins, Humphries, Jackson, Lake, Macon, Obion, Robertson, Shelby, Smith, Sullivan, Unicoi and Union counties. *El. tetraedra* was first reported from Tennessee by Reynolds, *et al.* (1973).

20. *Eisenoides carolinensis* (Michaelsen, 1910)—*Helodrilus carolinensis* Michaelsen; *Eisenia pearsei* Stephenson; *Eisenia carolinensis* Cernosvitov.

Tennessee Distribution: Chester, Cumberland, Henry, Houston, Marion, Perry, Sevier, Warren, Wayne and Weakley counties. *Es. carolinensis* was first reported from Tennessee by Gates (1955).

21. *Eisenoides lonnbergi* (Michaelsen, 1894)— *Allolobophora lonnbergi* Michaelsen; *Eisenia lonnbergi* Michaelsen; *Helodrilus lonnbergi* Smith.

Tennessee Distribution: Sevier county. *Es. lonnbergi* was first reported from Tennessee by Gates (1942).

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[2]Obtained after the original survey.

22. *'Lumbricus' eiseni* Levinsen. 1884—*Allolobophora eiseni* Friend; *Bimastos eiseni* Friend; *Eisenia eiseni* Graff.

Tennessee Distribution: Benton and Humphries counties. *'L.' eiseni* was first reported from North America by Reynolds *et al.* (1973).

23. *Lumbricus rubellus* Hoffmeister, 1843.

Tennessee Distribution: Anderson, Bedford, Blount, Bradley, Campbell, Carter, Cheatham, Claiborne, Clay, Cocke, Coffee, Cumberland, Davidson, DeKalb, Fentress, Franklin, Giles, Grainger, Greene, Grundy, Hamblen, Hamilton, Hancock, Hawkins, Henry, Hickman, Houston, Jackson, Jefferson, Johnson, Knox, Lewis, Loudon, MsMinn, Marion, Meigs, Morgan, Monroe, Montgomery, Overton, Perry, Pickett, Putnam, Rhea, Roane, Scott, Sevier, Smith, Sullvan, Sumner, Unicoi, Union, Washington, Weakley and Wilsoun counties. *L. rubellus* was first reported from Tennessee by Reynods (1972).

24. *Lumbricus terrestris* Linnaeus, 1758—*Lumbricus herculeus* Savigny; *Lumbricus agricola* Hoffmeister; *Lumbricus studeri* Ribaucourt.

Tennessee Distribution: Anderson, Blount, Campbell, Carter, Claiborne, Cocke, Hawkins, Hickman, Jefferson, Polk, Roane, Sullivan and Unon counties. *L. terrestris* was first reported from Tennessee by Reynolds, *et al.* (1973).

25. *Octolasion cyaneum* (Savigny, 1826)—*Octolasium cyaneum* Michaelsen.

Tennessee Distribution: Anderson, Blount, Carroll, Davidson, Dickson, Fayette, Fentress, Franklin, Giles, Grundy, Knox, Lincoln, Meigs, Monroe, Moore, Roane, Sevier, Shelby, Wayne, Weakley and White counties. *O. cyaneum* was first reported from Tennessee by Reynolds, *et al.* (1973).

26. *Octolasion tyrtaeum* (Savigny, 1826)—*Allolobophora profuga* Rosa; *Octolasium lacteum* Oerley.

Tennessee Distribution: All counties except Fayette, Hardeman, Hardin and McNairy. *O. tyrtaeum* was first reported from Tennessee by Gates (1959).

New Records:

county	792
state	14
continent	1

GLOSSARY

The glossary is presented here to assist in the use of the key to the sexually mature Lumbricidae of Tennessee. Additional definitions and illustrations can be found in Stephenson (1930), Causey (1952), Gerard (1964), Ljungstrom (1970) and Gates (1972).

Clitellum (girdle)—a regional epidermal swelling, where gland cells secrete material to form the cocoon.

types: 1) cingulum (annular)—one which encircles the body.
2) saddle—one which encompasses the dorsal and lateral portions of the body.

convention: xxvi, xxxii-xxxvii, xxxiii means it is generally found on segments xxvii-xxxii but may in some individuals overlap on to xxvi and/or xxxiii.

Dorsal pores—small single intersegmental apertures in the mid-dorsal line (mD) leading to the coleomic cavity.

convention: first dorsal pore 5/6 means that the first dorsal pore is found in the intersegmental furrow between segments 5 and 6.

Female pores (oviducial pores)—external openings for the oviducts on segment xiv near and ventrad of the mid-lateral line (mL = *eq.*); usually more difficult to see than the male pores.

Genital tumescences (genital markings)—in Lumbricidae, areas of modified epidermis (glandular swellings) without distinct boundaries and through which follicles of genital setae open.

Male pores (spermiducal pores, prostatic pores)—external openings for the vas deferens and the liberation of sperm during copulation; generally in Lumbricidae, they are conspicuous near the mL on segment xv.

Male sterility—when clitellar tumescences are maximal and ovarian egg strings are long; all, a combination, or none of the following will guarantee male sterility, only suggest it in any given individual. Many cases of repeated evidence are required before a species can be considered male sterile or parthenogenetic:

1) adult retention of juvenile testes
2) adults with juvenile seminal vesicles and no evidence of sperm
3) absence of irridescence on the male funnels at maturity indicates no mature sperm aggregations
4) absence of similar irridescence in male ducts and/or spermathecae
5) no external abrasive spermatophores

Peristomium—the first body segment, containing the mouth, asetal.

Prostomium—the anterior lobe projecting in front of the peristomium and above the mouth.

types: epilobic—peristomium partly divided.

tanylobic—peristomium completely divided

Seta (chaeta)—bristle, solid rod secreted by cells at ental end of a tubular epidermal ingrowth, the setal follicle.

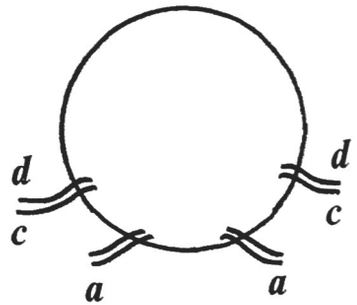
types. 1) general—sigmoid shape with pointed outer tip
2) genital—associated with genital tumescences and/or gonopores, not sigmoid
3) penial—associated with male pores, not sigmoid

Setal formulae—the distance between setae written usually as a ratio.

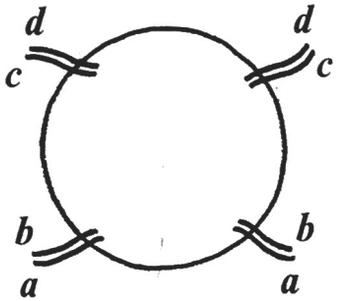
convention: *aa:ab:bc:cd:dd* = 9:3:6:2:20
u = circumference (umfang)

Setal pairings:

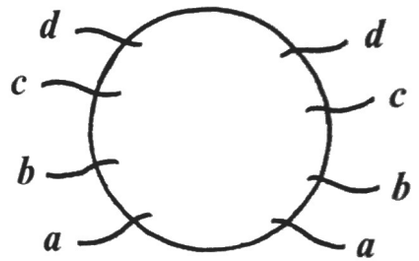
closely



widely



separate



Seminal vesicles (sperm sacs)—storage sacs for an earthworm's own sperm until copulation.

Spermathecae (seminal receptacles)—pouches developed in the septa which receive sperm from another individual during copulation; the sperm is stored here until the period of cocoon laying.

Tubercula pubertatis (ridge of puberty)—glandular swellings, if present, appearing near the ventro-lateral margins of the clitellum; they may be continuous or discontinuous and vary in size and shape.

KEY TO THE SEXUALLY MATURE LUMBRICIDAE OF TENNESSEE

LUMBRICIDAE: Setae 8 per segment. male and female pores well in front of the clitellum. clitellum usually saddle-shaped and never beginning before segment xx.

1.	Tubercula pubertatis small sucker-like discs on segments xxxi, xxxiii and xxxv; color usually green; clitellum xxviii, xxix-xxxvii ... *Allolobophora chlorotica*
1′.	Tubercula pubertatis not sucker-like, color not green ... 2
2.(1′)	Male pores equatorial on xiii; female pores on xiv; often yellowish in color ... *Eiseniella tetraedra* (part)
2′.	Male pores on xv; female pores on xiv ... 3
3.(2′)	Color red ... 4
3′.	Color not red ... 11
4.(3)	Setae closely paired ... 5
4′.	Setae widely paired or separate ... 5
5.(4)	Prostomium tanylobic ... 6
5′.	Prostomium epilobic ... 7
6.(5′)	Clitellum xxvi, xxxi, xxxii; Tubercula
6.(5)	Clitellum xxxi, xxvii-xxxii; Tubercula pubertatis xxviii-xxxi ... *Lumbricus rubellus*
6′.	Clitellum xxxi, xxxii-xxxvii; Tubercula pubertatis xxxiii-xxxvi ... *Lumbricus terrestris*
7.(5′)	Spermathecae and Tubercula pubertatis present ... 8
7′.	Spermathecae and Tubercula pubertatis absent ... 9
8.(7)	Tubercula pubertatis xxviii-xxx; clitellum xxiv, xxv, xxvi-xxxii, sometimes striped with alternate transverse dark and light bands; male tumescences present ... *Eisenia foetida*
8′.	Tubercula pubertatis xxvii-xxix; Clitellum xxiv-xxxi; never striped with alternate transverse bands; male tumescences present ... *Eisenoides carolinensis*

9.(7′) a. Clitellum xx-xxx ..... Bimastos gieseleri
b. Clitellum xxii-xxix ..... *Bimastos tumidus*
c. Clitellum xxiii-xxviii (cingulum) ..... *Bimastos palustris*
d. Clitellum xxiv-xxx ..... *Bimastos parvus*
e. Clitellum xxiv-xxxi ..... *Bimastos beddardi*
f. Clitellum xxiii, xxiv-xxxii, xxxiii ..... *Bimastos longicinctus*
g. Clitellum xxiv, xxv-xxxi, xxxii ..... *Bimastos heimburgeri*
h. Clitellum xxvii-xxxvii ..... *Bimastos zeteki*

10.(4′) Clitellum xxvii, xxviii-xxxiii, xxxiv; Tubercula pubertatis xxxi-xxxiii ..... *Dendrobaena octaedra*

10′. Clitellum xxvi, xxvii-xxxi, xxxii; Tubercula pubertatis, if present, xxviii, xxix-xxx ..... *Dendrobaena rubida*

11.(3′) Pigmented 12

11′. Not pigmented 16

12.(11) Prostomium tanylobic; Tubercula pubertatis absent; Clitellum xxiv-xxxii, xxxiii ..... *'Lumbricus' eiseni*

12′. Prostomium epilobic; Tubercula pubertatis present 13

13.(12′) Setae widely paired; Clitellum xxii, xxiii-xxvi, xxvii; Tubercula pubertatis xxiii, xxiv-xxv, xxvi ..... *Eiseniella tetraedra* (part)

13′. Setae closely paired 14

14.(13′) Male tumescences absent; Clitellum xxiii, xxiv-xxx; Tubercula pubertatis xxvi-xxviii ..... *Eisenoides lonnbergi*

14′. Male tumescences present 15

15.(14′) Clitellum xxv, xxvi, xxvii, xxviii-xxxiv, xxxv; Tuberculata pubertatis xxxi-xxxiii ..... *Allolobophora trapezoides* (part)

15′. Clitellum xxvi, xxvii, xxviii-xxxiv, xxxv, xxxvi; Tubercula pubertatis xxxii-xxxiv ..... *Allolobophora longa*

16.(11′) Setae widely paired at least posteriorly 17

16′. Setae closely paired 18

17.(16) Clitellum xxix-xxxiv; Tubercula pubertatis xxx-xxxiii ..... *Octolasion cyaneum*

17′. Clitellum xxx-xxxv; Tubercula pubertatis xxxi-xxxiv ..... *Octolasion tyrtaeum*

18.(16′) Tubercula pubertatis absent; Clitellum xxvii-xxxiii ..... *Allolobophora muldali*

18′. Tubercula pubertatis present 19

19.(18′) Tubercula pubertatis xxxi-xxxiii 20

19′. Tubercula pubertatis xxix-xxxi; Clitellum somewhat flared xxv, xxvi-xxxii ..... *Eisenia rosea*

20.(19) Clitellum xxvii, xxviii-xxxiv; Genital tumescences often present in xxviii, present or absent in xxxiii-xxxiv; male sterile; often pale ..... *Allolobophora trapezoides* (part)

20′. Genital tumescences not present in xxviii; made fertile 21

21.(20′) Clitellum xxvii-xxxiv; Genital tumesecences often present in xxvi, and absent in xxxiii; often dark ..... *Allolobophora tuberculata*

21′. Clitellum xxvii, xxviii, xxix-xxxiv, xxxv; Genital tumescences often present in xxvii and xxxiii; often pale ..... *Allolobophora turgida*

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