Earthworms of the Upper Whitewater Valley[1] (East-Central Indiana)

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Introduction

Despite the ubiquity of earthworms as soil inhabitants and their extensive use as fish bait there has been very little investigation of their distribution, natural history and ecology. In 1914 Heimburger (9) published the only regional paper on the earthworm fauna of Indiana. He presented a preliminary list of 14 species.

This paper, while local in scope, is presented as the second contribution to the knowledge of the earthworm fauna of Indiana. The species listed herein include five not found by Heimburger but expected as they have been reported in regional papers from surrounding states. A sixth and unexpected species, *Eisenia carolinensis*, has hitherto been reported from only North Carolina, Virginia and Louisiana.

The collections of earthworm specimens upon which this paper is based were obtained during the summers of 1957, 1958 and 1959 in the Upper Whitewater Valley. For the purposes of this paper the area of the "Upper Whitewater Valley" is defined as that part of the Whitewater drainage basin which is north of Union County, Indiana. This includes all of Wayne County and parts of Henry and Randolph Counties, Indiana. It also includes small portions of Preble and Darke Counties, Ohio.

Since all but the strictly aquatic Oligochaetes are commonly termed "earthworms" I did not restrict my collecting to the soil dwelling species. Species characteristically found in such microhabitats as stream edges, manure piles, compost heaps, and forest litter were also obtained. Collections of soil species were obtained by digging and sorting cores of earth to a depth of one foot.

The study was hampered because collections had to be made during the summer when many species are quiescent instead of during the spring and late fall when earthworms are most active. However the list of earthworms presented here, when compared with those published from surrounding states, indicates that only a few known species remain to be found. Moreover, a faunistic survey would seldom, if ever, be considered complete because of the inevitable introduction of new species by the multifarous activities of man.

Taxonomy, Nomenclature and Identification

The particular arrangement of families and genera followed in this paper is from Stephenson (13). For identification of species I used Smith (12), Olson (11) and Gates (8). The nomenclature corresponds to that listed in Gates (5).

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There are a number of current taxonomic problems relating to the classification of earthworms. These problems will be dealt with later in the notes concerning the various species listed.

A conservative arrangement and listing of earthworms species has been followed in this paper. For instance, *Diplocardia* is identified to genus only; no formae of *Allolobophora caliginosa* are included; and specimens which might have been termed *Bimastos gieseleri* by some authors are listed as *Bimastos tumidus* because diagnosis failed to clearly indicate to which species they belong.

LIST OF EARTHWORMS

Family: Megascolecidae

Genus: *Diplocardia*

As stated above, this genus was not identified to species. I was thwarted by the unresolved taxonomy and the inherent difficulties involved in identifying diplocardian species.

Diplocardia is a distinctly endemic genus of earthworm. It is limited to North America and has been reported from a large number of states. Heimburger (9) reported four species from various counties of Indiana.

In this study they were found to be soil species often occurring at depths of six to twelve inches. None was found associated with concentrations of organic matter.

Diplocardia spp. appeared in 22 of the 71 collections making it one of the four most common earthworms in the area in terms of the number of times it was collected. (See Table 1.)

Family: Glossoscolecidae

Genus: *Sparganophilus*

Sparganophilus eiseni Smith, 1895—This genus of earthworm is endemic to North America. Smith (12) states that *S. eiseni* is abundant in the mud of the bottom and margins of many rivers and lakes east of the Mississippi River. Heimburger (9) reported it from Fulton and Marshall Counties in the northern part of Indiana.

My specimens of this limiculous earthworm were collected from a muddy flat along Clear Creek upstream from West Test Road bridge. The mud was rich in organic matter and chemical analysis disclosed 4.3 percent organic carbon. There was no growing vegetation where the worms were found nor was the site under water.

Their presence along this stream has been known for several years. (Oral communication, Dr. Murvel Garner.)

Family: Lumbricidae

Genus: *Eiseniella*

Eiseniella tetraedra (Savigny) 1826 forma *typica* Michaelsen, 1900—This peregrine species has attained wide distribution through inadvertent introduction by European settlers. It is reported in nearly all state lists of earthworm fauna.

However, it is scarcely an abundant earthworm as its habitat seems to be limited to wet soils of high organic content. I collected specimens

from an aquatic habitat in a greenhouse, near a sewage overflow stream and from a woodland site.

In faunistic studies from surrounding states the closely related *Eiseniella tetraedra* forma *hercynia* has been reported in association with forma *typica* which differs from the former in a two segment anterior displacement of the spermaducal pores. In this study none of forma *hercynia* was found, however they are to be expected.

Genus: *Eisenia*

Eisenia carolinensis Michaelsen, 1910—This species of earthworm has an interesting history. It was discovered and named by Michaelsen who intercepted it in a shipment of plants received at Hamburg from Fayettesville, North Carolina. The species remained in oblivion from then until 1955 when Gates (8) published a report on collections from North Carolina, Virginia and Louisiana.

Eisenia carolinensis is reported for the first time for Indiana and for the areas west of the Appalachians. Two large clitellate specimens were collected from different sites in Lewis' Woods near Williamsburg, Indiana. This woods is considered a "virgin type" forest and has been used by Earlham College for various soil and ecology studies. There is no evidence such as dumped fish bait that can account for the presence of this species. Extensive digging on the collecting sites has failed to turn up additional specimens.

This species can also be reported from Lawrence County, Indiana where it was collected on the north bank of the White River near the river bridge on the Buddha-Lawrenceport Road. Here in July of 1957, '58, and '59 collections of 20-30 specimens were made. The worms were quite active and showed no signs of a quiescence. Of the specimens collected only five were clitellate. A few were aclitellate while many were large (10-12 cm. long) but juvenile, i.e. showed no sign of sexual maturity. Identification was based on a diagnosis of the clitellate specimens. It was possible, in this case, to separate *E. carolinensis* from other species because their posterior 30-40 segments are characteristically square in cross-section while alive.

The presence of this species along a river bank may be anomolous because of the possibility of their having been introduced by fishermen.

Eisenia foetida (Savigny) 1826—The manure worm or brandling is abundant throughout Europe and wherever Europeans have settled. It is widely distributed throughout the United States.

Eisenia foetida restricts itself to areas of organic wastes and seldom ventures into the soil. Occasionally one will be found under the bark of a rotting log. The fact that this earthworm thrives in culture beds has made it the worm one is most apt to buy for fish bait. The ease with which they are propagated has led to their sale among organic gardening faddists. It is debatable, however, whether they have any ability to amend the soil as they do not naturally occur there.

My specimens were collected from a pile of rotting cow manure (the worms avoided the fresh manure) and from coarse gravel in the bed of an intermittent raw sewage stream.

Though the collections of *E. foetida* were limited to two, with occasional specimens appearing in other collections, there is no doubt that they

could have been found on virtually any farm where livestock wastes were permitted to accumulate.

Eisenia rosea (Savigny) 1826—This European peregrine is widely distributed in North America. It is reported from eastern Canadian provinces, Maine, Massachusetts, New York, Ohio, Indiana, Illinois, Missouri, Louisiana, Georgia, Arizona, California, Lower California, Connecticut, Michigan, Arkansas and Oklahoma.

An examination of descriptions of my collecting sites discloses a wide variety of habitats. It is a soil species and is often found in asociation with *Allolobophora caliginosa, Lumbricus rubellus* and *Lumbricus terrestris.*

In the summer it is quite commonly found in a quiescent state; balled up in the soil within a foot of the surface.

This species was the only one in which insect parasitization was noted. Dipteran larvae probably of the cluster fly, *Pollenia rudis,* were found in three *E. rosea* collected in a chicken yard near a dwelling.

Genus: *Dendrobaena*

Dendrobaena octaedra (Savigny) 1826—This species, of European origin, is reported from a few states. These include Ohio, Illinois, Colorado, Washington, New York, and Michigan. It is reported from Indiana for the first time.

Only one site is reported for the collection of this species. The extent of the area over which they could be found within an unpastured dry hillside woods was not investigated.

In this instance they can be termed a woodland species which prefers the litter and A_1 horizon of the soil. It was found in association with *Octolasium lacteum* which was being collected for a feeding experiment.

Dendrobaena subrubicunda (Eisen) 1874—This species is widely distributed in Europe and various parts of the world. In North America it has been reported from eastern Canadian provinces, Massachusetts, New York, Ohio, Indiana, Missouri, Colorado, California, Louisiana, Illinois, and Arkansas.

Small and pigmented, *D. subrubicunda* was found in abundance in a compost pile which received garbage and weeds. They were first found in the pile during the extremely wet summer of 1958. Examination of the site a year later on June 19, 1959 disclosed the material in the pile was quite dry and contained no earthworms. Olson (11) noted their presence in areas of sewage contamination associated with *E. foetida* so it is presumed that they may be expected wherever concentrations of organic waste exist.

Ten specimens were collected in association with *Bimastos tumidus, Eisenia rosea* and *Octolasium lacteum.*

Genus: *Allolobophora*

Allolobophora caliginosa (Savigny) 1826—This species is credited by Stephenson (13) with being the commonest of all earthworms taking the whole world into consideration. It has attained a world wide distribution and it is not necessary to list here the places it has been found.

A. caliginosa appears as the most abundant earthworm in my collections as it occurs in 60% of them. (See Table 1.)

TABLE 1

Relative abundance of species as indicated by a comparison of the number of times contained in collections and the total number collected

	Species	Times	pct. total (70)	Number	pct. total (800)
1.	*Allolobophora caliginosa*	42	60	245	31
2.	*Octolasium lacteum*	32	46	138	17
3.	*Diplocardia spp.*	22	36	86	11
4.	*Lumbricus rubellus*	21	30	134	17
5.	*Eisenia rosea*	14	20	31	4
6.	*Allolobophora chlorotica*	7	10	30	4
7.	*Eisenia foetida*	5	7	27	3
8.	*Eiseniella tetraedra* forma *typica*	5	7	9	1
9.	*Sparganophilus eiseni*	2	3	50	6
10.	*Lumbricus terrestris*	2	3	8	1
11.	*Eisenia carolinensis*	2	3	2	0.25
12.	*Dendrobaena octaedra*	1	1.4	15	2
13.	*Dendrobaena subrubicunda*	1	1.4	9	1
14.	*Bimastos tumidus*	1	1.4	5	0.6
15.	*Bimastos tenuis*	1	1.4	3	0.4
16.	*Bimastos longicinctus*	1	1.4	1	0.12

Eaton (2) has stated that it is "the most abundant, wide spread and ecologically adaptable species in the United States." Soil and a reasonable amount of moisture seem to be the only requisites for the presence of this species. I find as did Murchie (10) that "it was not taken from manure, nor has it been found in truly aquatic habitats."

In view of certain complications concerning classification I have chosen to list my specimens belonging to the "caliginosa complex" as *Allolobophora caliginosa*. [For information concerning the classification complications see: Cain (1), Evans (3, 4), and Gates (6, 7).]

Allolobophora chlorotica (Savigny) 1826—Another of the European earthworms which has invaded North America, it has been reported from the eastern Canadian provinces, New York, Ohio, Indiana, Illinois, Missouri, District of Columbia, North Carolina, Colorado, California, and Michigan.

This greenish worm has a sluggish behavior and is usually contorted when removed from the soil. It is found in wet and usually highly organic or polluted soils. However, I found it on two occasions in association with *L. terrestris* in home gardens.

Genus: *Bimastos*

Bimastos tumidus (Eisen) 1874—This species has been reported only from New York and Ohio. It is reported from Indiana for the first time. The absence of this species from reports may be due to the class similarity

between this species and *B. gieseleri* (Ude) 1895 and *B. gieseleri* var. *hempeli* Smith 1915. The latter have been reported from five states.

Smith (12) suggested the possibility that *B. tumidus* and *B. gieseleri* may be identical so I chose to list my specimens as *B. tumidus* since a diagnosis of characteristics failed to clearly indicate to which species they belonged.

Bimastos longicinctus Smith and Gittens 1915—To date this species has been reported from Illinois, Ohio, Arkansas and Michigan. It is reported from Indiana for the first time.

Although Smith (12) stated that this species occurs abundantly in the soil of lawns and parks and nearby woods of Urbana, Illinois, it has not been reported as abundant in any other localities where it has been found.

I can report only one specimen. It was found in a chicken yard where *Allolobophora caliginosa* are abundant in season.

Bimastos tenuis (Eisen) 1874—Smith (12) pointed out that, "of the genus *Bimastos* only *B. tenuis* has attained anything like world wide distribution. All the other members of the genus are presumably indigenous and form a quite homogenous group." It has been reported from all parts of North America.

Heimburger (9) reported this species, as *Helodrilus constrictus*, from under logs near Culver. My single collection of three specimens was taken in Lewis' Woods. Murchie (10) noted that it prefers the litter of forest soils but will also be found near the surface in moist stream bank soils.

Genus: *Octolasium*

Octolasium lacteum Orley 1881—This worm is widely distributed in Europe and has been reported from many sectors of the United States. Gates (5) lists it for New York, Ohio, Illinois, Indiana, Missouri, Colorado, California, Mexico, and Massachusetts. More recently it has been reported from Michigan and Arkansas.

An examination of my collecting data indicates that it prefers organic conditions with some moisture stability. Nearly all my collections were made in woodland. The remainder were from alluvium, peat, and polluted soil.

It is interesting to note that this species is greatly disturbed by digging and can often be made to surface by shaking a spade embedded in the soil.

Genus: *Lumbricus*

Lumbricus rubellus Hoffmeister 1843—This peregrine species has found its way to most areas of North America and is reported from eastern Canada, Massachusetts, New York, Ohio, Missouri, Michigan, Washington, Oregon, California and Arkansas. It is reported from Indiana for the first time.

According to a local bait dealer this species known as the "red leaf worm" is preferred by him and he does not handle the "stinkin" *Eisenia foetida*. This worm would rank second in prevalence and is the one quite commonly found crawling in the street after heavy rains. It prefers a concentration of organic matter such as buried or rotting leaf litter. Polluted soils are also good places to find *L. rubellus*. I found in one

instance a tremendous concentration of this species in gravel soaked with raw sewage effluent.

Lumbricus terrestris Linnaeus, 1758 (part) Muller 1774 (part)—This well known, large earthworm is another European peregrine which has attained wide distribution. It is reported for the first time from Indiana where it is, no doubt, widely distributed over the state.

In my experience the habits of *L. terrestris* are slightly different from other soil species. They are seldom taken in digging during the summer because they retreat into their long deep tunnels. In certain seasons they may be found under boards or other trash on the surface of the soil. Evidences of their presence are the characteristic middens of leaves and leaf petioles with which they may cover their burrow openings.

The presence of eight *L. terrestris* in my collections is no indication of relative abundance. It only indicates they were not found with the methods of collecting used.

Summary

The investigation reported here concerns a survey of earthworm fauna of the Upper Whitewater Valley (East-central Indiana) carried out during the summers of 1957, 1958 and 1959.

A conservative approach to the listing of species has been followed.

Sixteen species are reported for the survey area. Six of these are new records for the state.

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