Northwest Science Notes

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Lumbricid Earthworms in the Palouse Region

Abstract

Farmers, gardeners, and ecologists view earthworms as beneficial soil organisms indicative of healthy soils. Earthworms in the Palouse region of eastern Washington and northern Idaho have not been well documented. Since the early 1900s, most of the Palouse had been converted to dryland farming except for intermittent streams and areas too rocky to till. We surveyed 46 sites in spring 1999 to determine the occurrence and distribution of earthworm species within the agricultural landscape. Although species diversity in the agricultural fields was low, three species are reported in the survey area for the first time. No native earthworms were found. Ten alien lumbricid species were found. The most common, *Aporrectodea trapezoides*, was found at 65% of all sites. Of the farmed field sites, 61% contained one or more species. This preliminary survey provides the baseline knowledge necessary to design future studies on earthworms.

Introduction

The distribution of earthworms (Annelida: Oligochaeta) of the Palouse region of eastern Washington and northern Idaho is largely unknown (James 2000). The Washington giant earthworm (*Driloleirus americanus*: Megascolecidae) is the only native worm known from the area (James 2000). Intensive tillage and conversion of steppe grasslands to annual small grain cropping have greatly reduced the habitat for *D. americanus* (Black et al. 1998), which was last collected in 1978 (Wells et al. 1983).

Most earthworms found in the Palouse are members of the family Lumbricidae, all of which are thought to be introduced from Europe (James 2000). Land use and management practices can affect earthworms (Chan 2001). For example, summer-fallow is a tillage-intensive, agricultural practice whereby no crop is grown and the soil is void of surface residues for up to 16 mo out of every two-year cropping cycle. Typically eight or more tillage operations occur during a fallow period. Even where fallow is not practiced, reducing tillage can improve habitat for earthworms (Chan 2001). Recently there has been increased adoption of no-till or direct seed practices by farmers in the region who are concerned about the health and quality of their soil. These farmers equate healthy earthworm populations with high quality soil. Some Palouse farmers who seed directly without tillage often observe abundant populations of earthworms, yet others are disappointed that their fields do not contain earthworms. They expect earthworms to become abundant when they cease tilling, but absence of worms may reflect ecological (worms cannot exist there) or zoogeographical (worms have not yet arrived) causes (Reynolds 1998).

We documented earthworm species at 46 sites in and around the Palouse region of eastern Washington and northern Idaho in spring 1999. Our objective was to determine the occurrence and distribution of earthworm species in the area, focusing on the agricultural landscape in the Palouse

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region. James (2000) summarized the distribution of earthworm species in the broader ecoregion of the Columbia Basin, based on earlier surveys reported by Fender (1985). We thought more specific and recent observations were needed on species distribution of worms in local fields to address farmer's concerns.

Study Area and Methods

The study area included the Washington and Idaho Palouse and adjoining areas (Figure 1). Most of the native shrub steppe vegetation of the area has been converted to agriculture, predominantly dryland wheat (Black et al.1998). We sampled 46 sites. Most were located in fields with a history

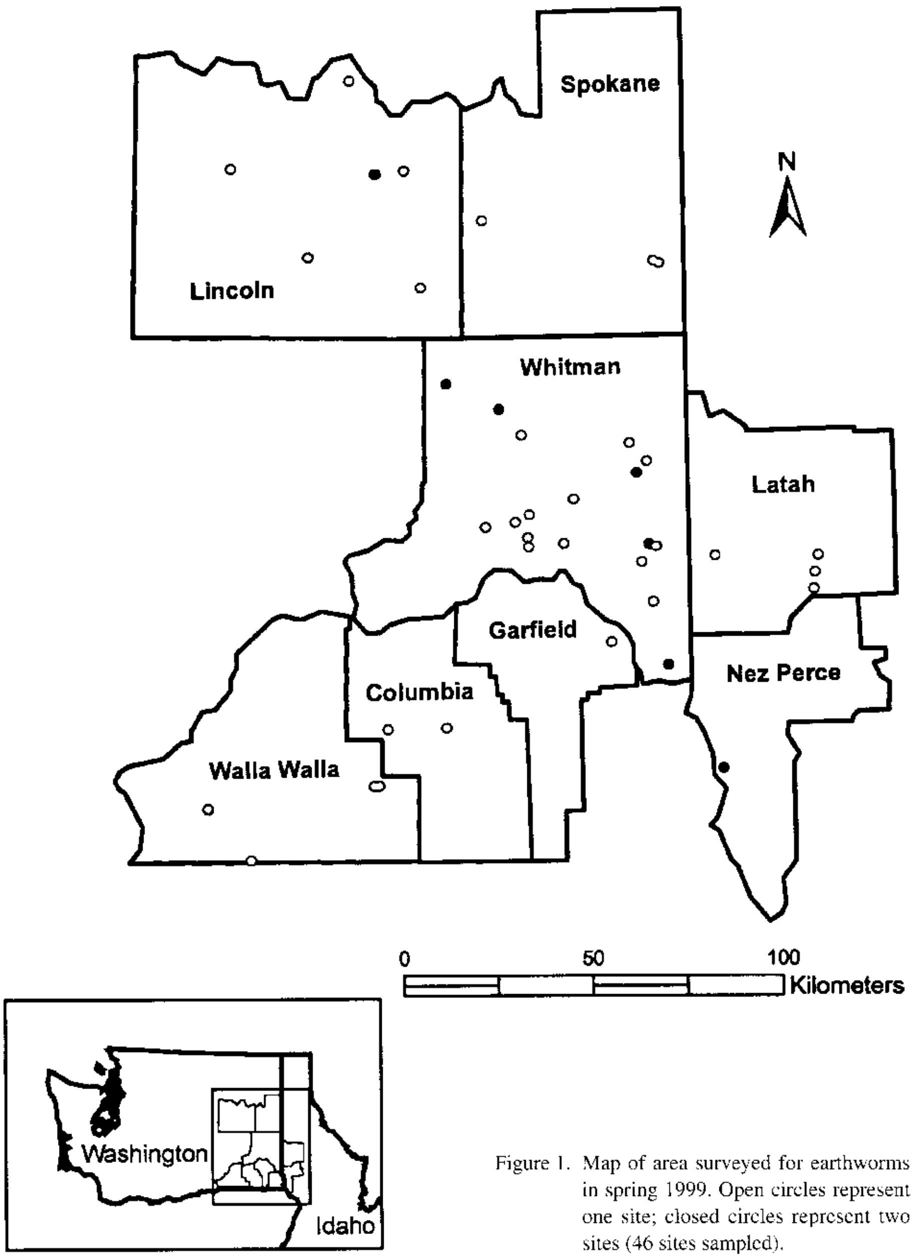

Figure 1. Map of area surveyed for earthworms in spring 1999. Open circles represent one site; closed circles represent two sites (46 sites sampled).

of conservation tillage where we knew the farmer (n=*29*). As we traveled from field to field, we sampled other sites that we thought might support earthworms. These sites were adjacent to waterways, in perennial vegetation, along road rights-of-way, or old homesteads (n=*17*).

We collected worms from February to May 1999. At each sample site, we dug, hand-sorted, and examined six spades of soil for worms. These six samples were distinct and randomly located within a 10-m^2 area. If immature worms were found we continued sampling to find adults with developed clitella for positive identification. Live adult worms were transported to the lab for identification. We identified worms based on external morphology of sexually mature specimens using keys by Schwert (1990) and Fender (1985). Nomenclature followed Fender (1985).

Results

We did not find *Dendrodrilus americanus*, but we found 10 lumbricid species during our survey (Table 1). *Aporrectodea trapezoides*, the most common species, was found at 65% of all sites. In the agricultural field sites we found four species, three of which were in less than 15% of the fields. Diversity in the agricultural field sites was low. Of the 29 agricultural field sites, 11 lacked worms, 11 had one species, 6 had two species, and 1 had three species.

The Washington State University campus had the greatest worm diversity with eight species found in the agronomy teaching garden. Of the 10 species detected in our study only *Eiseniella tetraedra* and *Allolobophora chlorotica* were not found at this site. Species diversity was also high adjacent to waterways or in low-lying pastures. In early July 2000, *A. chlorotica* was identified adjacent to a seasonal waterway at one of the sites surveyed in 1999. That site had six worm species. Two other pasture sites each had five species.

TABLE 1. Species occurrence (%) at all sites, in agricultural field sites, and in the other sample locations (adjacent to creeks, rights-of-way, pastures, and campus).

Species	All sites (n=46)	Agricultural field sites (n=29)	Other sites (n=17)
Aporrectodea trapezoides	65	55	82
Aporrectodea tuberculata	28	10	59
Lumbricus terrestris	24	14	41
Aporrectodea turgida	20	10	35
Aporrectodea rosea	11	0	29
Dendrodrilus rubidus	4	0	12
Eiseniella tetraedra	2	0	6
Allolobophora chlorotica	2	0	6
Eisenia fetida	2	0	6
Octolasion cyaneum	2	0	6
No worms	24	38	0

Aporrectodea rosea, Dendrodrilus rubidus, and *Octolasion cyaneum* were detected for the first time in our study area (Table 2). *Aporrectodea rosea* was found in five of the survey locations, on campus, along streams, and in pastures. *Dendrodrilus rubidus* was found in a pasture adjacent to a perennial creek and under straw in the agronomy garden on campus. *Octolasion cyaneum* is common on the WSU campus. Other species reported by previous investigators (Fender 1985, James 2000) that we did not find were *L. rubellus* and *O. tytraeum* (Table 2).

TABLE 2. Lumbricid worm species found in this and previous surveys (Fender 1985, James 2000).

Species	Spring 1999 survey	Previous surveys
Allolobophora chlorotica	+	+
Aporrectodea rosea	+	
Aporrectodea trapezoides	+	+
Aporrectodea tuberculata[1]	+	+
Aporrectodea turgida	+	+
Dendrodrilus rubidus	+	
Eiseniella tetraedra	+	+
Eisenia fetida	+	+
Lumbricus terrestris	+	+
Lumbricus rubellus		+
Octolasion cyaneum	+	
Octolasion tytraeum		+

[1] referred to as *Allolobophora tuberculata* in James (2000).

Discussion

The presence or absence of lumbricid worms in agriculture fields is probably related to a combination of past livestock practices, homesteads, proximity to watercourses, climate, and soil management. No worms were found at 11 of the 29 agricultural field sites. Nine of these were clustered in the northwest corner of the survey area, in western Whitman and Spokane Counties and all of the sites in Lincoln County. Summer fallow was practiced extensively in this area in the past, although recently more growers direct seed, without any tillage. Our survey sites in this area had been under direct seed management for a minimum of four years. These sites are located in an area that is as dry as many of the sites that have worms, but it is colder. Perhaps worms cannot survive these conditions or they have not arrived yet. An adjacent abandoned homestead harbored both *Aporrectodea trapezoides* and *A. tuberculata*.

Two other field sites without worms included a shallow soil in southern Whitman County on the breaks of the Snake River and a deep coarse soil in Touchet, western Walla Walla county (Figure 1). The shallow soil dries completely to bedrock each summer. Earthworms persist in dry environments by burrowing deeply into moist soil or aestivating during drought. Thus, refuge from dry conditions may not exist at this site. Although the soil is deep in Touchet, the lack of moisture (less than 250 mm rain per year) and coarser soil texture may explain the absence of worms at that site. These sites might support worms if they were introduced.

The locations chosen and timing of our survey influenced the results. For example, in midsummer, July 2000, we found an additional worm species (*Allolobophora chlorotica*) at a site we had surveyed in early spring. Perhaps juveniles of this species were present during our spring sampling, but we found no adults. Worm species that live in permanent deep burrows, like the night crawler (*Lumbricus terrestris*) can escape shallow sampling by withdrawing into their burrows. We checked sites with large diameter worm burrows (greater than 6 mm) carefully because *D. americanus* is believed to inhabit permanent or semi-permanent deep vertical burrows (James 2000) much like *L. terrestris* and adults of both species are of similar diameter. However, at all sites with large diameter burrows, we found adult *L. terrestris*.

Acknowledgments

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