

PRESENCE OF EARTHWORMS (*ANNELIDA:* *OLIGOCHAETA*) IN THIRTEEN BRAZILIAN SOIL CLASSES: A REVIEW

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Abstract: Soil can be understood as a mixture of unconsolidated material with a solid phase, composed of organic and inorganic matter, a porous phase containing gases and a liquid phase, containing water and soil solution. Currently in the Brazilian Soil Classification System there are 13 soil classes. The presence of fauna, especially earthworms, in different types of soil brings diverse benefits that need to be scientifically elucidated. The objective of this work is to carry out a bibliographical review on the benefits of earthworms (*Annelida: Oligochaeta*) present in the 13 classes of Brazilian soils. The SCIENCE DIRECT database and the CAPES journal portal were used to obtain the scientific articles that make up the review portfólio. Such data were collected on a 10-year time basis, that is, scientific works produced from 2014 to 2024, obtained through the use of specific terms (keywords). The quantitative analysis was based on the typification of works found in the databases, such as: research articles, review articles, encyclopedias, among others. The qualitative analysis was based on the main contributions and results achieved in the present works found on the topic. Thus, the information was crossed and compiled to prepare this bibliographic review.

Keywords: Macrofauna. Bioindicators. SiBCS.

INTRODUCTION

Soil can be understood as a complex, three-dimensional system that performs several functions, characterized by its high mutability, being composed of three phases (solid, liquid and gas) presenting interactions of physical, chemical and biological processes (URRA et al., 2019).

A soil sequence that occurs in an area, being distinct from each other depending on the topographic location it occupies, is called a toposequence (figure 01) or Catena (GUERRA; GUERRA, 2008). In Brazil there are thirteen

classified soil classes, they are: Argissolos, Cambissolos, Chernossolos, Espodossolos, Gleissolos, Latossolos, Luvisolos, Neossolos, Nitossolos, Organossolos, Planossolos, Plintossolos e Vertissolos (SANTOS et al., 2017).



Figure 01: Toposequence of three soils present at the State University of Maringá from top to bottom: Latossolo, Nitossolo and Neossolo.

Source: The authors (2024).

In relation to the biodiversity present in different types of soil, in a small amount of soil sampled, for example, we can find several living beings, invisible to the naked eye, but with a fundamental role for the soil system (DIAS, 2017).

These beings are part of the fauna, which can be classified into micro, meso and macrofauna. The microfauna has organisms that have bodies smaller than 2mm, the mesofauna (between 0.2 to 2mm) and the macrofauna (above 2mm). Examples of macrofauna individuals are: earthworms (*Oligochaeta*); ants (*Hymenoptera*); snake lice (*Diplopoda*); beetles (*Coleoptera*), among others (SWIFT et al., 1979).

One of the representatives that most contributes to good soil quality are earthworms (*Annelida: Oligochaeta*). Like other macrofauna, these beings are important indicators of changes in terrestrial agroecosystems, responding quickly to chemical and physical disturbances caused to soils (FRANCO et al., 2016).

When digging and moving within the soil, earthworms aerate it, which facilitates the penetration of root systems and water into the profiles, in addition to ingesting portions of soil and decomposing organic residues into humus (EMBRAPA, 2024). In addition to these disturbances, climatic conditions, vegetation cover and soil management also contribute to changes in earthworm populations (MERLIM et al., 2005).

Thus, given the importance of earthworms for the soil as a whole, this bibliographic review aims to quantify articles on the subject, seeking to identify the benefits of earthworm activity in the thirteen classes of Brazilian soil and whether there is any work that shows that earthworm activity in a given soil is more beneficial than in another(s), for example: in an organosol, a predominantly organic soil, can an earthworm contribute preponderantly more than in a neosol, a young and predominantly rocky soil?

METHODOLOGY

During the months of January and February 2024, a review was carried out to prepare this article, based on the methodology of SARTOR et al. (2021). The work of these authors follows the premises of PULLIN and STEWART (2006) when proposing suggestions for carrying out bibliographic research, classifying them into stages.

Planning is the initial stage of a bibliographic survey, where it will be necessary to question the gaps and results to be obtained in the research, on the topic in

question (SARTOR et al., 2021). In addition to these, a protocol, strategies for carrying out the research, inclusion and extraction of data and subsequent analysis of them, satisfactorily complement a bibliographic review (PULLIN; STEWART, 2006).

After presenting the thirteen soil classes and demonstrating the importance of earthworms to them, the guiding questions of this review were defined, which are presented in table 01.

1 ^a	How much research and experiments have been carried out on the subject?
2 ^a	What are the results obtained?
3 ^a	What can be done to increase research related to the topic?

Table 01: Guiding questions for the bibliographic survey.

Source: The authors (2024).

The SCIENCE DIRECT database and the Periodical Portal of the Coordination for the Improvement of Higher Education Personnel (CAPES), belonging to the Ministry of Education and Culture (MEC), were used to search for scientific articles on the topic, using of specific terms “earthworms in the soil” and “earthworms in Brazilian soil classes” for them. The research was carried out over the last ten years, that is, from 2014 to 2024, as it is considered a very representative time range for the development of this review.

To obtain the most relevant results, publications understood as “gray literature” were removed, such as unpublished research or published in a non-commercial manner (research report, newsletter, conference proceedings, etc.), and for the final stage, selecting the articles, the connection of the works with the theme of this bibliographic review was verified, where those that were not related were discarded.

The selected articles were compiled into a list in Excel software (the results will be shown in figures 01 and 02) after extracting the main

data such as title, year of publication, study location and digital object identifier.

Once the list was organized, quantitative and qualitative analyzes of the articles were carried out, the first using the descriptive statistical method, aiming to achieve a bibliometric approach, to categorize articles by: year, place of study, periodical of publication and methodology used. For the qualitative analysis, the most relevant results on the benefits of earthworm activity in the soil were selected, and the information was gathered in a practical and consistent way to prepare this bibliographical review.

RESULTS

For the term “Earthworms in the soil” in the SCIENCE DIRECT database, from 2014 to 2024, 7,297 research articles were found; 327 encyclopedias and 1,312 book chapters, as shown in Figure 01.

For the specific term “earthworms in Brazilian soil classes”, in the SCIENCE DIRECT database, from 2014 to 2024, 239 research articles were found; 33 encyclopedias and 129 book chapters, as shown in Figure 02.

For the term “earthworm in the soil”, through the CAPES Portal, from 2014 to 2024, 111 scientific publications were found. For the term “earthworms in Brazilian soil classes”, using the same database and time period, only one publication was found entitled “Analysis of the leaching potential of the insecticide

sulfoxaflor in soils” by MARQUES et al. (2020).

DISCUSSION

Todos os trabalhos científicos encontrados no Portal da CAPES, também estavam presentes na base de dados SCIENCE DIRECT. Quando utilizado o primeiro termo, ou seja, “minhoca no solo”, que pode ser compreendido como genérico, houve um retorno grande de produções científicas, porém quando utilizado o termo mais específico (“benefícios das minhocas nas classes de solos brasileiros”), ambas as bases de dados, no período de dez anos, de 2014 a 2024, retornaram apenas um trabalho científico e que mesmo assim não foca no objetivo desta presente revisão bibliográfica.

CONCLUSION

Although there are several scientific works on earthworms and their role in soils, there is no specific research that shows the benefits of these beings in relation to the thirteen classes of Brazilian soils, that is, there is still no work that specifically deals with these benefits in Latossolos, Organossolos, Argissolos, among others, which opens up a range of possibilities for new work and experiments. It is hoped that this review will arouse the interest of students and/or researchers in the agricultural and biological areas to begin studies in this line of research.

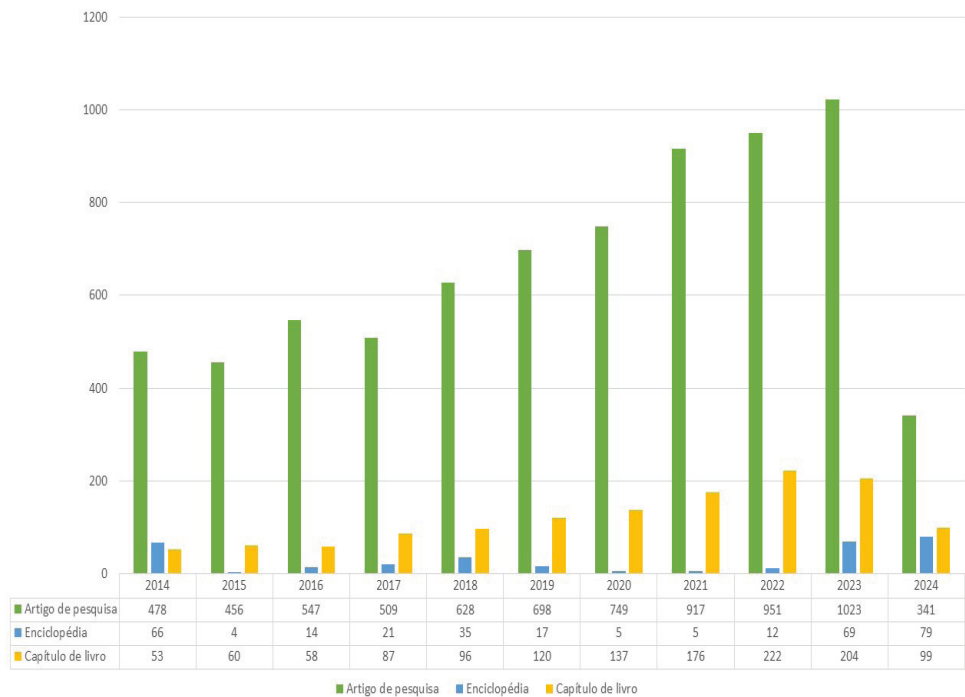


Figure 01: Scientific productions found in the SCIENCE DIRECT database, from 2014 to 2024, for the term “worms in the soil”.

Source: The authors (2024).

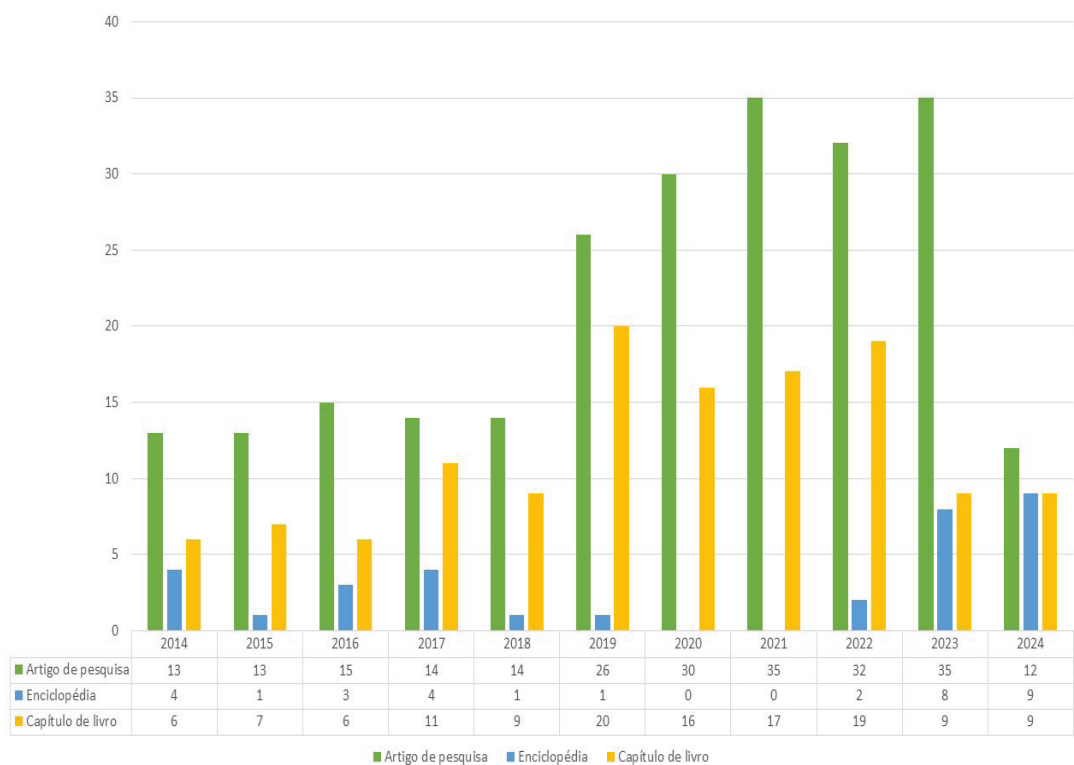


Figure 02: Scientific productions found in the SCIENCE DIRECT database, from 2014 to 2024, for the term “earthworms in Brazilian soil classes”.

Source: The authors (2024).

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